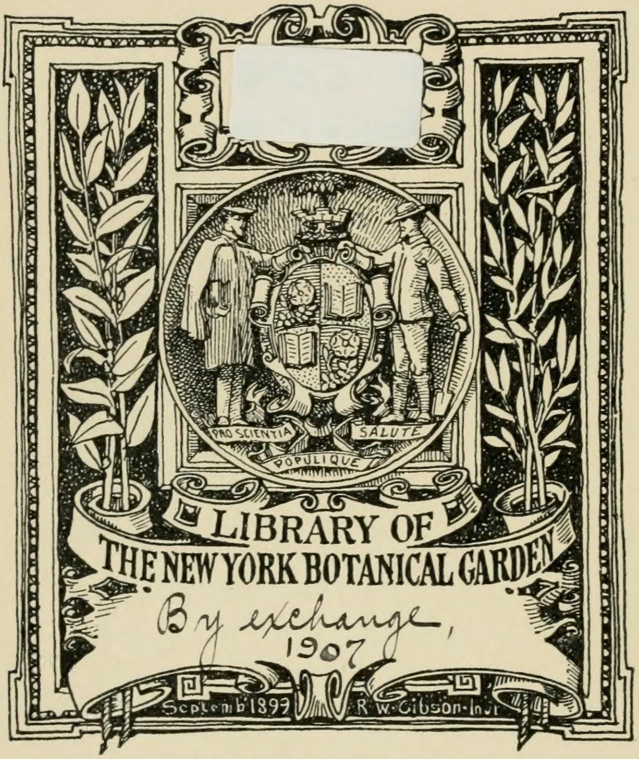
SHOUT
SHARE
IT


PRO SCIENTIA
SALUTE
POPULIQUE
Septemb 1899
R. W. Gibson Inv.

LIBRARY OF
THE NEW YORK BOTANICAL GARDEN
By exchange,
1907

Thirty-Ninth Annual Report

OF THE

MISSOURI

State Board of Agriculture

A Record of the Work for the Year 1906.

ALSO VALUABLE INFORMATION ON BREEDING AND FEEDING LIVE STOCK,
IMPROVING THE FERTILITY OF THE SOIL, GROWING CROPS, DAIRYING,
AGRICULTURE AND LIVE STOCK STATISTICS, ETC.

PUBLISHED 1907.

LIBRARY
NEW YORK
BOTANICAL
GARDEN.

THE HUGH STEPHENS PRINTING COMPANY,
JEFFERSON CITY, MO.

X A
.N 7373
v. 39
1906

Officers of State Board of Agriculture, 1907.

President—S. W. Hudson, Buckner.
Vice-President—Norman J. Colman, St. Louis.
Secretary—Geo. B. Ellis, Columbia.
Assistant Secretary—J. B. Rector, Columbia.
Institute Clerk—S. M. Jordan, Stanberry.
Treasurer—W. A. Bright, Columbia.
State Veterinarian—Dr. D. F. Luckey, Columbia.
State Highway Engineer—Curtis Hill, Columbia.

EXECUTIVE COMMITTEE.

S. W. Hudson, Buckner.
Norman J. Colman, St. Louis.
H. J. Waters, Columbia.
W. C. Howell, Ulman.
W. C. Hutchison, Jamesport.
M. B. Greensfelder, Clayton.
A. T. Nelson, Lebanon.

EX-OFFICIO MEMBERS.

Governor of Missouri—Jos. W. Folk.
Superintendent of Schools—H. A. Gass.
Dean Agricultural College—H. J. Waters.

CORPORATE MEMBERS.

LIBRARY
NEW YORK
BOTANICAL
GARDEN.

Cong. dist.	Name.	Residence.	County.
	(Term expires July 20, 1907.)		
6	John Deerwester	Butler	Bates.
9	J. A. Potts	Mexico	Audrain.
10	M. B. Greensfelder	Clayton	St. Louis.
11	N. J. Colman	St. Louis City	Colonial Security Bldg.
12	W. R. Wilkinson	St. Louis City	212 N. Main Street.
	(Term expires July 20, 1908.)		
2	W. C. Hutchison	Jamesport	Daviess.
3	Allen M. Thompson	Nashua	Clay.
5	S. W. Hudson	Buckner	Jackson.
13	E. E. Swink	Farmington	St. Francois.
14	Ferd J. Hess	Charleston	Mississippi.
16	A. T. Nelson	Lebanon	Laclede.
	(Term expires July 20, 1909.)		
1	W. B. McRoberts	Monticello	Lewis.
4	John L. Christian	Rockport	Atchison.
7	N. H. Gentry	Sedalia	Pettis.
8	Wm. C. Howell	Ulman	Miller.
15	John J. McNatt (Hold-over.)	McNatt	McDonald.

OFFICERS OF STATE FAIR DIRECTORY.

President—E. E. Swink, Farmington.
Vice-President—A. M. Thompson, Nashua.
Secretary—J. R. Rippey, Sedalia.
Treasurer—Chas. E. Yeater, Sedalia.

NOV 25 1907

EXECUTIVE COMMITTEE STATE FAIR DIRECTORY.

E. E. Swink, Farmington.
A. M. Thompson, Nashua.
A. T. Nelson, Lebanon.
W. B. McRoberts, Monticello.
John Deerwester, Butler.
N. H. Gentry, Sedalia.
Norman J. Colman, St. Louis.
S. W. Hudson, Buckner.

STATE VETERINARIAN AND DEPUTIES.

D. F. Luckey, State Veterinarian	Columbia
T. F. Arnold, Deputy State Veterinarian	Lewistown
Horace Bradley, Deputy State Veterinarian	Windsor
E. Brainerd, Deputy State Veterinarian	Memphis
W. L. Berry, Deputy State Veterinarian	Joplin
L. D. Brown, Deputy State Veterinarian	Hamilton
Henry Boettner, Deputy State Veterinarian	Perryville
James Cullison, Deputy State Veterinarian	Charleston
Chas. Doerrie, Deputy State Veterinarian	Boonville
H. V. Goode, Deputy State Veterinarian	St. Joseph
E. M. Hendy, Deputy State Veterinarian	Jefferson City
R. B. Love, Deputy State Veterinarian	Springfield
J. H. McElroy, Deputy State Veterinarian	Grant City
R. C. Moore, Deputy State Veterinarian	Kansas City
H. M. McConnell, Deputy State Veterinarian	Marshall
F. W. O'Brien, Deputy State Veterinarian	Hannibal
R. P. Poage, Deputy State Veterinarian	Shelbina
J. H. Slater, Deputy State Veterinarian	Richmond
Sam Sheldon, Deputy State Veterinarian	Trenton
Stanley Smith, Deputy State Veterinarian	Columbia
T. E. White, Deputy State Veterinarian	Sedalia
H. H. Wolf, Deputy State Veterinarian	Maryville

Associate Organizations.

IMPROVED LIVE STOCK BREEDERS' ASSOCIATION.

President—R. W. Brown, Carrollton.
Vice-President—Ed. Hall, Carthage.
Vice-President—S. L. Brock, Macon.
Vice-President—George Kitchen, Gower.
Vice-President—Dr. Geo. C. Mosher, Kansas City.
Vice-President—June K. King, Marshall.
Vice-President—W. B. Cully, Bunceton.
Vice-President—Ben. W. Harned, Beaman.
Vice-President—J. W. Boles, Auxvasse.
Vice-President—Ed. Wilson, Stanberry.
Secretary—Geo. B. Ellis, Columbia.
Treasurer—J. H. McCulloh, Creighton.
Executive Committee—W. P. Harned, Vermont; Benton Gabbert, Dearborn, and above officers.

MISSOURI CORN GROWERS' ASSOCIATION.

President—C. O. Raine, Canton.
Vice-President—Geo. H. Sly, Rockport.
Vice-President—Wm. Wallace, Vandalia.
Vice-President—R. S. Harriman, Pilot Grove.
Vice-President—P. E. Crabtree, Hannon.
Vice-President—T. P. Chandler, Farmington.
Secretary-Treasurer—M. F. Miller, Columbia.

MISSOURI STATE DAIRY ASSOCIATION.

President—Dr. Geo. C. Mosher, Kansas City.
First Vice-President—J. M. Smith, Brookfield.
Second Vice-President—Thos. Shields, Eureka.
Secretary—R. M. Washburn, Columbia.
Treasurer—D. B. Matthews, Kirksville.

MISSOURI SHEEP BREEDERS' ASSOCIATION.

President—A. T. Grimes, Greenwood.
Vice-President—J. W. Boles, Auxvasse.
Secretary-Treasurer—M. V. Carroll, Sedalia.

DIRECTORS.

W. W. Waltmire, Raymore.
H. R. Brasfield, Unionville.
L. V. Heuser, Deerfield.
S. C. Haseltine, Springfield.
W. F. Cooper, Windsor.
John A. Rankin, Tarkio.

LETTER OF TRANSMITTAL.

State Board of Agriculture, Office of the Secretary,
Columbia, Mo., June 18, 1907.

To Hon. Joseph W. Folk, Governor of Missouri:

Sir—In compliance with the law, I have the honor to transmit herewith a report of the work of the State Board of Agriculture for the year 1906.

Very respectfully,

GEO. B. ELLIS, Secretary.

TABLE OF CONTENTS.

Pages.

- Annual Meeting ... 9-46
  - Secretary's report ... 18-23
  - Secretary's financial statement ... 24-35
  - Treasurer's report ... 36-37
  - Report State Veterinarian ... 38-46
- Farmers' Week ... 47-348
  - Missouri State Dairy Association ... 53-113
  - Improved Live Stock Breeders' Association ... 114-295
  - Corn Growers' Association ... 296-348
- Improvement of Missouri Herds ... 349-388
- Missouri Crop Statistics ... 389-401
- Tabulated Veterinary Reports ... 402-416

ANNUAL MEETING.

MINUTES OF PROCEEDINGS.

State Board of Agriculture, Office of the Secretary,
Columbia, Mo., Dec. 18, 1906.

The forty-second annual meeting of the Board of Agriculture convened in the office of the Secretary, Columbia, Mo., December 18, 1906, at 1:30 p. m. In absence of the President, Vice-President Hudson called the Board to order. Roll call by the Secretary showed the following members present: S. W. Hudson, W. B. McRoberts, John L. Christian, N. H. Gentry, W. C. Howell, John Deerwester, M. B. Greensfelder, Norman J. Colman, W. R. Wilkinson, W. C. Hutchison, Allen M. Thompson, E. E. Swink, A. T. Nelson, H. J. Waters and W. T. Carrington.

The following members were absent: Governor Jos. W. Folk, J. A. Potts, F. J. Hess, J. J. McNatt.

Upon motion of Mr. Waters, the rules were suspended and the reading of the minutes dispensed with, and the minutes adopted as printed in the 38th annual report.

The Secretary read his report, and upon motion of Mr. Thompson, the report was approved and adopted, and ordered printed in the 39th annual report of the Board.

The State Veterinarian made a verbal report, and asked for time to prepare a written report of the work of his department, which request was granted.

Upon recommendation of State Veterinarian, Dr. J. H. McElroy of Grant City and Dr. T. F. Arnold of Lewistown were appointed deputy veterinarians.

REPORT OF AGRICULTURAL COLLEGE COMMITTEE.

Mr. President:

We, your committee, appointed to examine into the affairs of the College of Agriculture and Experiment Station, have discharged that duty, and beg to submit the following report:

We find the grounds, buildings and live stock well kept and in good condition.

We are pleased to note the number of important improvements in the equipment of the College made during the past year, among which may be mentioned:

The farm machinery laboratory, a substantial stone structure, commodious, and apparently well designed for its purpose.

The hog house, which is now nearing completion, seems to be well adapted to the purposes for which it is designed.

A much needed plant house for the Department of Botany is now in process of erection.

It is with especial pleasure that we note the improvement in the number and character of the live stock used for instructional purposes on the farm. This includes additions to the Shorthorn and Hereford breeding herds, to the different breeds of hogs, the addition of a number of draft horses, and improvement in the flocks of sheep. While we are pleased to note these improvements, we strongly urge still larger expenditures along these lines.

The character of the cattle and sheep used for experimental work now in progress could scarcely be improved upon.

Soil Survey.—We especially desire to commend the progress made in the State Soil Survey. We find that the preliminary survey has covered practically the whole of South Missouri, that more than 200 samples of soil have been collected, representing all the principal types in this portion of the State, nearly one-half of which have already been analyzed, including samples from the following counties: Barry, Barton, Bates, Cape Girardeau, Cass, Cedar, Christian, Crawford, Dent, Dunklin, Franklin, Gasconade, Hickory, Jefferson, Johnson, Lawrence, McDonald, Maries, Morgan, Nodaway, Pemiscot, Phelps, Polk, Pulaski, Reynolds, Shannon, Texas, Vernon, Washington, Wright.

We observe, further, that experimental fields for a more extensive study of the crops best adapted to these different soils, their fertilizer requirements and the best crop rotations, have been established as follows: Monroe City, Monroe County; Unionville, Putnam county; Billings, Christian county; Purdy, Barry county; from all of which the College already has two years' results. One year's results have been obtained from experimental fields at Lamar, Barton county; Adrian, Bates county; Cuba, Crawford county; Dixon, Pulaski county, and Poplar Bluff, Butler county.

It is of interest to note also that there have been established special experiments to determine the feasibility and profitableness of tile drainage for certain areas of the State. Such drainage fields have already been established at Lamar, Barton county, and at Monroe City, Monroe county, and arrangements are practically completed for similar experiments at Poplar Bluff, Butler county, Centralia, Boone county, and at Trenton, Grundy county.

The importance of this work would amply justify the Legislature in supporting it much more liberally than in the past, in order that it may be greatly extended.

Recommendations.—It is the opinion of your committee that Missouri's Agricultural College should not be conspicuous at the great international live stock shows by the absence of her students trained in stock and grain judging, nor by the absence of representatives of its herd and flocks fed and prepared by the students. It seems to us that the College can in no other way so effectively impress the high character of its work and the importance of this sort of instruction upon the public as by joining the colleges of neighboring states in an active participation in these great international shows. This is particularly true of such shows as the American Royal Live Stock Show, held at Kansas City, and the International Live Stock Show, held at Chicago. It is strongly urged that the Board of Curators provide the College with sufficient funds and with all of the facilities for entering upon this enterprise in a manner which will reflect creditably upon the stock breeders and feeders of the State.

We desire to renew our recommendation of last year, with reference to the dairy barn, which, as was then pointed out, is entirely inadequate and unsuited to the purpose. Scarcely any progressive, private dairyman in this State has so illy ventilated and poorly arranged a barn for his dairy herd. It is earnestly recommended that the Forty-fourth General Assembly make an appropriation for the erection of a model dairy barn in lieu of this one.

Among the urgent needs of the College for which the forthcoming Legislature should make provision are the following:

Additional teachers and asssistants	$8,000
Soil survey	15,000
Experiments	20,000
Animal husbandry, including purchase of pure bred stock	15,000
Equipment in dairy husbandry, botany, domestic science, agronomy, horticulture, veterinary science, and entomology	16,000
Refrigerating plant for dairy	3,000
Poultry plant, including equipment and instructors	10,000

Missouri is the leading poultry State in the Union. Our poultry products are worth annually approximately $70,000,000, exceeding in value our annual wheat and oat crop combined, and yet, aside from a week's lectures on this subject in the University, there is not a single dollar being expended in instruction or research in the entire State upon this important subject.

Pure Food Law.—A law regulating the sale of feed stuffs for live stock, similar to that now on the statute books for the control of the manufacture and sale of commercial fertilizers, should be enacted. Practically all of the states in the Mississippi Valley, except Missouri, have such a law, and the result is that Missouri is being made the dumping ground for all of the adulterated, spurious and worthless foods which have been driven out of our neighboring states by the enforcement of their laws. Our farmers, stockmen and citizens in towns and villages who keep horses and cattle are thus made to suffer the penalty of our neglect in this important matter.

It is likewise true that the Missouri market is open for the foods and drugs intended for human consumption, which are so badly adulterated, misbranded and deleterious to public health as to have been excluded from the markets of our surrounding states. The control of this matter, as well as that of the stock foods, should be placed in the hands of the Experiment Station.

BUILDINGS.

New Agricultural Building, $200,000.—The building now used by the College of Agriculture is the oldest owned by the University, was never adapted to the purposes, is entirely too small, is illy ventilated, and is not commensurate with the importance of agriculture in the University. We would strongly recommend, therefore, that the sum of $200,000 be appropriated for the erection of a new and suitable building, which would likewise serve as headquarters for the Board of Agriculture.

Veterinary Laboratory and Hospital, $50,000.—It should be borne in mind that Missouri is one of the leading live stock states in the Union. Necessarily, therefore, the loss from animal diseases is a heavy tax upon the stockman, and any instruction and investigations which will enable him to reduce this loss will add materially to the wealth of the State and be money wisely invested. The Forty-second General Assembly made an appropriation for this purpose, but it was against the collateral inheritance tax, and the money failed to come into the fund. The Forty-fourth General

Assembly is earnestly requested to repeat this appropriation.

The Leading Agricultural College in the World.—In the heart of the greatest agricultural region in the world—the Mississippi Valley—will grow up in the near future the greatest agricultural college in the world. To it will be attracted students from every civilized country on the globe. It will furnish the citizens of its own State with the best instruction of its kind to be had. Missouri, one of the richest of these states, with a more diversified agriculture than any other, and with the most central location, is peculiarly well suited to build such a college. The cost of an enterprise of this sort will necessarily be great, the time required for its building long. If Missouri is to have any part in this great progressive movement, and is to have an institution that is even creditable, much less distinguished, she must deal more liberally with it than in the past. Our neighboring states of Iowa, Illinois and Kansas have frequently, at a single session of their legislature, appropriated more money to their College of Agriculture than Missouri has given her's since it was established in 1870.

Assured Support.—It will not be sufficient to appropriate large sums of money to the College of Agriculture against a fund like the collateral inheritance tax, which may or may not materialize. The support of this College should be placed against the General Revenue fund of the State.

In order that a proper beginning may be made in the improvement of the College of Agriculture, it is earnestly recommended to the Board of Curators and to the Forty-fourth General Assembly that the $87,000 required for betterments, and itemized in this report, be asked for out of the General Revenue fund, and that the veterinary hospital and laboratory be placed upon the same fund. The agricultural building should be one of the early appropriations to come out of the collateral inheritance tax.

We approve of the suggestion to devote the $475,000 war fund to the erection on the University grounds of a memorial building to Missouri's soldiers in the late Civil war, this building to contain a great agricultural museum and convention hall for farmers' meetings, and to provide the headquarters for the Board of Agriculture until at least the new agricultural building shall have been completed. Respectfully submitted,

E. E. SWINK,
A. M. THOMPSON,
W. C. HUTCHISON,
Committee.

Upon motion of Governor Colman, the report was adopted.

Captain Joseph Frazier, commandant of University Cadets, was introduced by Mr. Greensfelder, and discussed a plan for the establishment of a larger military school. Mr. Waters moved to extend the Captain a vote of thanks for his remarks, which motion was adopted.

REPORT OF AUDITING COMMITTEE.

The Auditing Committee submitted the following report:

We, the undersigned committee, authorized to examine the books and accounts of the Secretary and Treasurer, beg leave to submit the following report:

We have carefully examined the vouchers authorized by the Executive Committee and the corresponding warrants issued by the President and Secretary of the different funds of the Board, as follows:

DISTRIBUTION ANNUAL REPORT FUND.

We find that vouchers Nos. 125-134, inclusive, for a total amount of $807.61, have been approved and corresponding warrants issued and paid, leaving no balance in said fund.

MONTHLY CROP REPORT FUND.

We find that vouchers Nos. 357-409, inclusive, for a total amount of $757.08, have been approved and corresponding warrants issued, leaving a balance unappropriated in this fund of $68.31. In this fund warrants Nos. 402, 404 and 406, total amount of $34.62, have not yet been presented to the Treasurer for payment, leaving a balance in the hands of the Treasurer of $102.93. When these warrants shall have been paid and cancelled the balance in the hands of the Treasurer will agree with the balance undrawn as shown by the Secretary's account.

EXPENSE OF MEMBERS' FUND.

We find that vouchers Nos. 613-668, inclusive, have been approved to the amount of $518.98, and corresponding warrants issued, leaving a balance of $281.02 in the hands of the Treasurer of the Board.

FARMERS' INSTITUTE FUND.

We find that vouchers Nos. 693-829, inclusive, have been approved for a total amount of $5,781.16, and corresponding warrants issued, leaving a balance unappropriated of $1,518.84. In this fund the Treasurer's statement shows that warrants Nos. 798, 802, 803, 804, 806, 807, 813, 814, 815, 816, 824 and 828, for a total amount of $819.57, have not yet been presented for payment, leaving a balance in the hands of the Treasurer of $2,338.41. When these warrants shall have been paid there will be an exact agreement between the books of the Secretary and Treasurer.

OFFICE EXPENSE FUND.

We find that vouchers Nos. 575-640, inclusive, for a total amount of $517.09, have been approved and corresponding warrants issued and paid by the Treasurer, leaving a balance of $82.91 in the hands of the Treasurer, which shows an exact agreement between the books of the Secretary and Treasurer.

STATE VETERINARY FUND.

We find that vouchers Nos. 1719-1886, inclusive, for a total amount of $8,668.11, have been approved and corresponding warrants issued, leaving a balance unappropriated of $1,331.89. In this fund the Treasurer's statement shows that warrants Nos. 1872, 1873 and 1880, for a total amount of $50.80, have not yet been presented for payment, leaving a balance in the hands of the Treasurer of $1,382.69. When these warrants shall have been paid and cancelled, the accounts of the Secretary and Treasurer will agree.

We find that the following warrants, which had been drawn by the President and Secretary, but had not been presented for payment at the last annual settlement, have been paid and cancelled by the Treasurer: Warrants Nos. 684, 686, 688 and 689, for total amount of $297.05, in the farmers' institute fund; warrants Nos. 1712 and 1713, for the amount of $134.85, on State Veterinary Fund.

The above statement shows an exact agreement as to expenditures and balances between the books of the Secretary and Treasurer, except the unpaid warrants, as above noted.

All of which is respectfully submitted.

W. T. CARRINGTON,
A. T. NELSON,
W. B. MCROBERTS,
Committee.

Upon motion of Mr. Colman, the report was adopted.

ELECTION OF OFFICERS.

The election of officers was the next order taken up, and the following officers were elected. In each case the election was by unanimous ballot.

President—S. W. Hudson.

Vice-President—Norman J. Colman.

Secretary—Geo. B. Ellis.

Assistant Secretary—J. B. Rector.

Treasurer—W. A. Bright.

The following were elected members of the Executive Committee:

S. W. Hudson, N. J. Colman, H. J. Waters, W. C. Hutchison, W. C. Howell, A. T. Nelson, M. B. Greensfelder.

It was moved by Mr. Gentry that all power vested in the Board of Agriculture be and is hereby delegated to the Executive Committee, and that the said committee is hereby authorized to act for the Board at all times when the full board is not in session.

Motion adopted.

It was moved by Mr. Waters that it is the sense of this Board that the salary of the Secretary should be increased to at least $2,500, and further that this recommendation be referred to a Legislative Committee, who shall present the matter to the next Legislature.

Motion carried.

It was moved by Mr. Carrington that a Legislative Committee, consisting of five members, of which President Hudson shall be chairman, be appointed, to whom all matters of legislation shall be entrusted.

Motion carried.

The Chair announced the Legislative Committee, as follows: Messrs. McRoberts, Swink, Thompson and Nelson.

It was moved by Mr. Waters, that a committee of two be appointed to advise with the State Veterinarian on proposed veterinary legislation.

Motion carried.

The Chair appointed Messrs. Gentry and Greensfelder on the committee.

The Board next discussed the future needs of the office, and made the following recommendations to the State Auditor as to amounts required for the next biennial period:

Salary of Secretary	$5,000
Clerical hire	2,400
Printing and distributing annual report	10,000
Farmers' institutes	12,000
Office expense	1,500
Expense of members	1,800
Crop reports and bulletins	2,500
Veterinary service	20,000

The report of the Secretary relating to good roads was called up by Mr. Carrington, and after a thorough discussion, in which the sentiments expressed were unanimously in favor of the recommendations, it was ordered that the Secretary and Mr. Carrington be appointed a committee to present the views of the Board to Governor Folk, and request that he embody same in his message to the Legislature.

There being no further business, Mr. Waters moved that the Board adjourn to meet in the Secretary's office on January 8th, 1907, to attend the meetings held under the auspices of the Board.

GEO. B. ELLIS, Secretary.

S. W. HUDSON, President.

Report of Secretary.

It is pleasing to note in this, the 42nd annual report to the State Board of Agriculture, the favorable contrast in a prospective with a retrospective view of agricultural conditions and possibilities. Only a few weeks ago the president of one of our great railway systems declared that "the prosperity of the nation depends upon a scientific and permanent agriculture." The President of the United States, in his annual message to Congress, declares that "the welfare of the tiller of the soil is vital to the welfare of the nation," and he also states that "the farmer represents a peculiarly high type of American citizenship." When the great financiers and those high in the councils of our country give expression to such pronounced views it augurs well for the farming classes.

The past year has been a reasonably prosperous one for Missouri farmers. We have just harvested a good corn crop, amounting to 233,209,625 bushels, which was worth at the average farm price 37 cents per bushel—$85,317,199. We produced this year 34,799,169 bushels of wheat, which brought the farmers $22,898,179. The drought which prevailed throughout the northern and central parts of the State during the spring and early summer greatly reduced the yield of hay and oats, and both these crops were lighter than since the drought year of 1901. The average yield of hay was .7 ton per acre, which is .3 ton below the average yield for the previous year. The average yield of oats was only 21.1 bushels, compared with an average yield of 27.6 bushels per acre the year previous. The deficiency in these crops, however, is largely made good by an increased acreage of other forage crops, such as alfalfa, cowpeas, millet and sorghum. These temporary droughts may be blessings in disguise, by introducing such legumes as alfalfa and cowpeas, both of which crops are steadily increasing in both acreage and yield. The total farm value of all crops for the year 1906 is $152,711,634, as compared with $157,501,572 for 1905.

THE WORK OF THE BOARD.

At the last annual meeting you instructed the Executive Committee to employ a competent assistant for the State Veterinarian. In compliance with this order, Dr. R. L. Allen, a graduate veterinarian, was appointed to the position of Deputy State Veterinarian, and he entered upon his duties February 15, 1906.

During the year 144 official visits have been made by the State Veterinarian and the deputies, not including the inspection of sheep scabies in Laclede county, and the fever tick inspection in the southern part of the State. The most common of the contagious diseases investigated was glanders among horses and mules. The ailment in 118 of the total of 144 visits was diagnosed glanders, and 160 animals were affected. This is an increase over the previous year of 48 horses and mules condemned on account of this disease. In Kansas City there were 79 animals, which was an increase of eleven, and in all of the rest of the State there was an increase over the previous year of 37 animals. Most all of this increase is due to the disease appearing in St. Louis, where horses have been condemned under State authority, and in an outbreak caused by infection, which western horses brought into Knox county.

FARMERS' INSTITUTES.

The interest in the farmers' institute work has equaled, if not exceeded, that of the years before, but on account of most of the meetings being held during the time of the political campaign, the attendance was somewhat reduced. A number of meetings, however, had from 100 to 500 in attendance, with unusual interest. Perhaps the banner meeting for the year in attendance and enthusiasm was at Pleasant Hope, Polk county, where it is estimated there were 2,000 people in attendance, but on account of lack of room, perhaps not more than 500 or 600 heard the lectures. The plan inaugurated last year, of holding meetings in rural school houses, has been continued, and forty such meetings have been held this year, and a number of other meetings are planned for during the winter. The plan is to hold a meeting in connection with the school; the parents are invited and one of the institute lecturers gives a lesson on some agricultural topic, which is, of course, adapted to the children, while the address of the other speaker is on some more practical subject. In the evening a farmers' meeting is held and, as a rule, the house is full of enthusiastic farmers.

While this plan is more expensive per individual instructed, I believe it is profitable, because of the number of farmers who hear the lectures who otherwise would not when the meetings are held only in larger places.

In this connection, I would recommend that an increased appropriation for institute work be asked for, and if it is secured, that an institute assistant be employed for the entire time. During the institute season he can attend the meetings, and during the rest of the year he can assist in the organization of the work and attend occasional meetings that are asked for continually throughout the year.

GOOD ROADS.

The question for a better system for road construction and maintenance in this State has been given a prominent place in our institute work. At most of the regular meetings the subject has been taken up, and in addition several road conventions have been held and are now arranged for. Early last spring Mr. G. H. Lawson of Livingston county, representing the business men and farmers of that county, proposed to the Board of Agriculture that they would furnish the necessary expense for paying premiums and advertising a good roads' convention, to be held under the auspices of the State Board of Agriculture, to be held in Chillicothe during the first week in September. This proposition was accepted and the convention was held, with an attendance of 200 regularly appointed delegates from other counties and a local attendance estimated at 4,000 to 5,000 people. During the convention three miles of improved dirt road were constructed in competition for a prize of $200.00. One of these roads was built by the citizens of Livingston county, another mile by the Smith Manufacturing Company, and the third by the Austin-Western Manufacturing Company; the first prize being awarded to a mile of road improved by the Austin-Western Company, which was over a clay gumbo bottom. For the best display of road machinery the award was a tie, and the premium divided between the Smith Manufacturing Company and the Austin-Western Manufacturing Company. At the conclusion of the convention the following resolutions were unanimously adopted:

First. We favor the creation by the next General Assembly of the office of State Highway Engineer, under the jurisdiction of the State Board of Agriculture, to co-operate with the local officers in the furtherance of good roads.

Second. To provide an adequate number of trained men for the supervision of road construction in the various localities of this State, we recommend the immediate establishment of a course in road engineering and the equipment of a suitable laboratory for the testing of road materials at the State University at Columbia.

Third. All the people of the State being interested in and benefitted by a better system of highways, State aid should be extended to the various counties for the construction and improvements of the public roads, such State aid being provided from new sources of revenue other than those now existing or in the treasury.

Fourth. Redress from the present distressing situation in road maintenance and construction can only come through judicial changes in our State Constitution, and such changes being possible more quickly and more surely by the adoption of a new Constitution covering adequate sources of revenue than by any amendment to the present Constitution, we, therefore, strongly urge upon the Legislature the calling of a constitutional convention at the earliest possible moment.

Fifth. We strongly endorse the drag as the most effective and practical method of maintaining dirts roads, and would suggest that some law be enacted whereby its more general employment for this purpose may be effected.

Continuing this campaign, I have asked the co-operation of the commercial clubs and county courts with our Board in holding district road conventions, and we have arranged for the following meetings under this co-operation: Maryville, December 19; Moberly, December 20; Kirksville, December 21; Mexico, December 22; Lamar, December 26; Harrisonville, December 27, and Sedalia, December 28. We have also arranged to co-operate with the county court organizations of the State to hold a State good roads' convention January 15 and 16 in Jefferson City. It is hoped by this agitation to crystallize public sentiment in favor of some broad, progressive system that will bring about better roads for the State, particularly to put road building and maintenance in the hands of an organized department of trained men, and furthermore, to provide for State aid.

CORN IMPROVEMENT AND SOIL FERTILITY.

Two other subjects, which have been presented at practically all of our institute meetings, are corn improvement and soil fertility. The great interest in the improvement of the corn crop—which represents practically 50 per cent of the value of all crops produced on the farm—I think, justifies the attention we have given this subject. This subject was first introduced in the State four years ago, and the great improvement in the quality of the corn exhibited at the local shows as well as at our State meetings has been marvelous. A leading seed corn grower of Illinois stated at our State institute last year that no state had made greater progress during the time than had Missouri. It is reasonable to suppose that the work is accomplishing something in the way of increasing the yield of corn. The statistics will show that during the last five years the State has produced a greater average yield per acre than for any five years during the history of the State. Of no less interest than the subject of corn improvement is the subject of soil fertility. The success of all our farm operations rests upon this important subject. Perhaps added interest has been given the subject because of the work recently taken up by the Agricultural College in inaugurating a soil survey of the State, and following this up with experiments in the use of fertilizers and in different rotations and the effects of drainage. I think it will be well for the Board to make a very active effort in assisting the Department of Agronomy in the Agricultural College in obtaining an appropriation of not less than $25,000 to continue the soil survey work and experimental plots during the next two years.

AGRICULTURAL EDUCATION.

Looking to the future welfare of the State, and particularly to the welfare of the farmers, I wish to call your attention to what I consider a pressing need for the education of the farmer boys and girls. Let me ask, what are the present opportunities for the farmer boy to obtain an agricultural training? In this State, after he graduates from the rural school, he must then leave home and parental oversight and go to some town or city for four years before he is qualified to enter the State Agricultural College; then four years more in Columbia before he graduates from the college course—eight years away from the farm and away from the influence of home. However desirable it may be for the average farm boy to obtain a complete four years' agricultural course, the actual conditions prove to us that but a very small per cent of them avail themselves of the opportunity. If you will pardon me for referring again to the message of the President of the United

States to Congress, I will quote from his message as follows: "In all education we should widen our aims. It is a good thing to produce a certain number of trained scholars and students; but the education superintended by the State must seek rather to produce a hundred good citizens than merely one scholar, and it must be turned now and then from the class book to the study of the great book of nature itself." You will remember that I discussed this subject in my last annual report, and I think the importance of the question justifies mention of it now. We have in this State about 300,000 farm homes; from the best estimate I can make, there are around 60,000 young farmers between the ages of 18 and 22 years. If the State could provide schools, where a practical farm course continuing through two or three years could be established, it would be of inestimable value to these young farmers and afford them an opportunity to obtain an education and training that would be invaluable in their farm work. The best way to establish these schools is a question for deep thought and consideration. I have suggested two plans: One—the establishing of country or district agricultural schools, and the other the establishing of a farm school in connection with the State University. I believe the importance of this question would justify the appointment of a special committee to urge this matter upon the Board of Curators and upon the next Legislature.

Respectfully,
GEO. B. ELLIS, Secretary.

SECRETARY'S FINANCIAL STATEMENT.

To the Board of Agriculture:

I beg leave to submit the following exhibit of the financial transactions of the Board for the year beginning December 20, 1905, and ending December 18, 1906, which shows the balances on hand at the beginning of the year, the requisitions drawn on the State Auditor, the warrants drawn on W. A. Bright, Treasurer of the Board, the balances in the Treasury of the Board, and the balances in the different funds remaining in the State Treasury:

DISTRIBUTION OF ANNUAL REPORT FUND.

Date.	War. No.	Name.	Dr.	Cr
1906				
May 1		To requisition	$300 00	
July 2	125	By S. H. Elkins		$10 00
“ 2	126	S. H. Elkins		140 00
Aug 4	127	American Express Co		63 33
“ 4	128	Pacific Express Co		106 73
“ 4	129	S. H. Elkins		168 00
“ 4	130	M., K. & T. R. R. Co		65 58
“ 4		To requisition	300 00	
Sept. 4	131	By American Express Co		83 87
“ 4	132	Pacific Express Co		141 30
“ 4	133	S. H. Elkins		21 69
“ 4	134	M., K. & T. R. R. Co		7 11
“ 4		To requisition	207 51	
Dec. 17		To overdraft	10	
			$807 61	$807 61

MONTHLY CROP REPORT FUND.

Date.	War. No.	Name	Dr.	Cr.
1905.				
Dec. 20		To balance	$125 39	
“ 20	357	By H. H. Banks		$7 50
1906.				
Jan. 12	358	S. H. Elkins		2 87
“ 12	359	W, A. Bright, transfer of balance from old to newtreasurer		117 89
Feb. 3	359a	By E. A. Cockefair		4 30
“ 3	360	S. H. Elkins		14 00
“ 3	361	American Express Co		2 25
“ 3	362	Columbia Typewriter Exchange		3 00
Mar. 6	363	S. H. Elkins		4 75
“ 6	364	L. F. Childers		40 00
“ 6	365	Columbia Statesman		10 75
“ 6	366	National Paper Co		6 25
“ 6	367	M., K. & T. R. R. Co		3 30
“ 6	368	S. H. Elkins		15 00
“ 6		To requisition	100 00	

MONTHLY CROP REPORT FUND—Continued.

Date.	War. No	Name.	Dr.	Cr.
1906.				
April 4	369	By S. H. Elkins		$19 00
“ 4	370	Wabash R. R. Co		2 49
“ 4	371	National Paper Co		45 37
“ 4	372	L. F. Childers		40 00
“ 4	373	S. H. Elkins		2 65
“ 4	374	S. H. Elkins		22 00
“ 4		To requisition	$200 00	
May 1	375	By L. F. Childers		45 00
“ 1	376	Columbia Statesman		17 75
June 6	377	By National Paper Co		26 75
“ 6	378	Smith Premier Typewriter Co		2 60
“ 6	379	S. H. Elkins		10 00
“ 6	380	S. H. Elkins		10 41
“ 6	381	L. F. Childers		40 00
“ 6	382	Columbia Statesman		6 50
“ 6		To requisition	100 00	
July 2	383	By L. F. Childers		42 00
“ 2	384	M., K. & T. R. R. Co		1 69
“ 2	385	S. H. Elkins		15 00
“ 2	386	S. H. Elkins		8 20
Aug. 4	387	W. A. Bright		5 00
“ 4	388	S. H. Elkins		2 20
“ 4	389	L. F. Childers		40 00
“ 4	390	Columbia Statesman		12 50
“ 4	391	S. H. Elkins		15 00
“ 4		To requisition	100 00	
Sept. 4	392	By Columbia Daily Tribune		6 50
“ 4	393	Columbia Statesman		9 50
“ 4	394	L. F. Childers		40 00
“ 4		To requisition	100 00	
Oct. 2	395	By S. H. Elkins		10 00
“ 2	396	Smith Premier Typewriter Co		4 25
“ 2	397	L. F. Childers		40 00
“ 2	398	S. H. Elkins		15 00
“ 2	399	S. H. Elkins		3 00
Oct. 10	400	Columbia Statesman		2 25
Nov. 1	401	S. H. Elkins		30 00
Dec. 4	402	Paul Hulett		1 50
“ 4	403	Eloise Kneisley		2 40
“ 4	404	W. H. Marr		3 12
“ 4	405	Scurlock Transfer Co		1 00
“ 4	406	S. H. Elkins		30 00
“ 4	407	Columbia Statesman		6 00
“ 4	408	Columbia Typewriter Exchange		1 48
“ 4	409	W. A. Bright		5 00
“ 4		To requisition	100 00	
“ 18		By balance		68 31
			$825 39	$825 39

EXPENSE OF MEMBERS FUND.

Date.	War. No.	Name.	Dr.	Cr.
1905.				
Dec. 19		To balance	$396 25	
“ 20	613	By M. B. Greensfelder		$26 60
“ 20	614	E. E. Swink		17 10
“ 20	615	C. F. Afflick		13 50
“ 20	616	N. J. Colman		13 00

EXPENSE OF MEMBERS FUND—Continued.

Date.	War. No.	Name.	Dr.	Cr.
Dec. 20	617	S. H. Prather		$23 82
" 20	618	W. T. Carrington		6 05
" 20	619	W. C. Howell		14 90
" 20	620	W. C. Hutchison		15 25
" 20	621	S. W. Hudson		15 80
1906.				
Jan. 12	622	John Deerwester		32 00
" 12	623	F. C. Hayman		25 25
" 12	624	A M. Thompson		31 20
" 12	625	J. J. McNatt		28 50
" 12	626	E. E. Swink		16 85
" 12	627	W. C. Howell		18 00
" 12	628	Geo. B. Ellis		5 30
" 12	629	C. F. Afflick		13 50
" 12	630	A. T. Nelson		57 00
" 12	631	W. A. Bright (transfer of funds to new treasurer) ($265 13)		
" 12	632	W. C. Hutchison		18 90
" 12	633	S. W. Hudson		13 40
" 12		To requisition	$200 00	
Feb. 3	634	By S. W. Hudson,		6 20
" 3	635	H. J. Waters		16 80
" 3	636	Geo. B. Ellis		16 30
" 3	637	W. C. Hutchison		15 70
Mar. 6	638	N. J. Colman		16 00
" 6	639	S. W. Hudson		2 75
" 6	640	W. C. Howell		17 50
" 6	641	W. C. Hutchison		15 70
" 6	642	S. H. Prather		16 00
" 6	643	Geo. B. Ellis		14 75
" 6		To requisition	100 00	
April 4	644	By W. C. Hutchison		15 00
" 4	645	S. W. Hudson		2 60
" 4	646	C. F. Afflick		18 50
" 4	647	Geo. B. Ellis		14 80
June 6	648	M. B. Greensfelder		8 90
" 6	649	S. W. Hudson		8 75
" 6	650	W. C. Hutchison		19 45
" 6	651	W. C. Howell		12 60
" 6	652	Geo. B. Ellis		5 30
Aug. 4	653	S. W. Hudson		9 00
" 4	654	M. B. Greensfelder		28 10
" 4	655	W. C. Hutchison		4 00
" 4	656	W. C. Howell		21 50
" 4	657	Geo. B. Ellis		14 31
" 4	658	S. H. Prather		22 00
" 4	659	W. C. Howell		21 15
" 4	660	W. C. Hutchison		7 00
" 4	661	S. W. Hudson		21 50
" 4	662	H. J. Waters		13 00
" 4	663	Geo. B. Ellis		19 70
" 9		To requisition	200 00	
Oct. 2	664	By N. J. Colman		21 00
" 10	665	H. J. Waters		17 30
" 10	666	Geo. B. Ellis		27 20
" 10	667	S. W. Hudson		2 50
" 10	668	W. C. Hutchison		16 45
" 10		To requisition	100 00	
Dec. 4		To requisition	200 00	
" 18		By balance		281 02
			$1,196 25	$1,196 25

FARMERS' INSTITUTE FUND.

Date.	War. No.	Name.	Dr.	Cr.
1905.				
Dec. 19		To balance	$369 51	
" 20	693	By J. C. Whitten		$17 75
" 20	694	J. W. Connaway		38 33
" 20	695	C. D. Lyon		103 10
" 20	696	C. M. Long		48 18
" 20	697	S. M. Jordan		42 32
" 20	698	American Express Co		9 02
" 20	699	G. W. Waters		253 87
" 20	700	H. J. Waters		18 19
" 20	701	P. Schweitzer		18 16
" 20	702	H. H. Banks		37 50
" 20	703	F. L. Kelso		20 00
" 20	704	S. H. Elkins		5 00
" 20	705	P. E. Crabtree		67 44
" 20	706	Columbia Statesman		8 00
" 20	707	H. P. Mason		150 00
" 20		To requisition	1,000 00	
1906.				
Jan. 12	708	By Jos. E. Wing		40 40
" 12	709	F. H. King		42 52
" 12	710	C. H. Eckles		8 40
" 12	711	G. W. Williams		81 54
" 12	712	W. H. Chandler		89 55
" 12	713	Columbia Printing Co		34 00
" 12	714	Geo. B. Ellis		50 00
" 12	715	Pacific Express Co		9 53
" 12	716	Hulett Bros		3 00
" 12	717	J. B. Rector		15 00
" 12	718	J. H. Pettit		25 56
" 12	719	J. D. Funk		33 00
" 12	720	W. A. Bright (transfer from old to new treasurer) ($532.65)		
" 12		To requisition	500 00	
Feb. 3	721	By Geo. B. Ellis		50 00
" 3	722	Smith Premier Typewriter Co		5 65
" 3	723	E. E. Laughlin		17 05
" 3	724	C. E. Thorne		29 40
" 3	725	C. O. Raine		68 12
" 3	726	C. M. Long		74 62
" 3	727	W. H. Chandler		50 00
" 3	728	Lewis W. Moore		3 40
" 3		To requisition	500 00	
Mar. 6	729	By C. O. Raine		70 35
" 6	730	Columbia Statesman		26 25
" 6	731	W. H. Chandler		42 25
" 6	732	C. M. Long		78 33
" 6	733	Geo. W. Williams		84 91
" 6	734	J. W. Connaway		25 20
" 6	735	E. E. Laughlin		85 85
" 6	736	Geo. B. Ellis		50 00
" 6	737	R. E. Hyslop		97 96
" 6	738	Binner Wells Co		2 07
April 4	739	Barnes-Crosby Co		20 94
" 4	740	S. H. Elkins		3 50
" 4	741	W. H. Chandler		51 80
" 4	742	Geo. B. Ellis		50 50
" 4	743	G. W. Williams		42 83
" 4	744	Smith Premier Typewriter Co		15 30
" 4	745	American Express Co		5 81
" 4	746	P. E. Crabtree		30 68
" 4	747	E. A. Grantham		3 90
" 4		To requisition	500 00	

FARMERS' INSTITUTE FUND.—Continued.

Date.	War. No.	Name.	Dr.	Cr.
1906.				
May 4	748	By Geo. B. Ellis		$51 08
" 4	749	P. E. Crabtree		28 57
June 6	750	By Geo. B. Ellis		55 30
" 6	751	National Paper Co.		21 25
" 6	752	S. H. Elkins		15 00
" 6	753	M. F. Miller		26 27
" 6	754	American Express Co.		3 99
July 2	755	R. E. Hyslop		50 00
" 2	756	Geo. B. Ellis		65 91
" 2	757	S. H. Elkins		5 50
Aug. 4	758	Geo. B. Ellis		50 00
" 4	759	F. P. Spalding		3 15
" 4	760	W. A. Bright		20 00
" 4	761	S. H. Elkins		5 00
" 4	762	Columbia Statesman		7 00
" 4	763	S. H. Elkins		30 00
" 4		To requisition	$500 00	
Sept. 4	764	By E. W. Stephens Pub. Co.		12 50
" 4	765	Geo. B. Ellis		50 00
" 4	766	J. B. Rector		31 62
Oct. 2	767	Geo. B. Ellis		50 00
" 2	768	S. H. Elkins		10 00
" 2	769	R. W. Clothier		56 49
" 2	770	The Liberal Enterprise		3 25
" 2	771	F. P. Spalding		9 17
" 2	772	Columbia Printing Co.		11 50
" 2	773	S. H. Elkins		11 00
" 2	774	S. H. Elkins		20 00
" 2	775	P. E. Crabtree		84 76
" 10	776	Columbia Tribune		2 50
" 10	777	S. M. Jordan		50 14
" 10	778	E. A. Trowbridge		17 00
" 10	779	Western Union		1 40
" 2		To requisition	1,000 00	
" 10	780	By Piedmont Banner		2 00
" 10	781	D. P. Leonard		25 15
" 10	782	E. E. Laughlin		59 72
Nov. 1	783	L. F. Childers		67 81
" 1	784	D. P. Ashburn		119 35
" 1	785	E. B. Forbes		26 06
" 1	786	C. D. Lyon		108 60
" 1	787	W. L. Howard		64 19
" 1	788	F. B. Mumford		35 40
" 1	789	P. E. Crabtree		96 70
" 1	790	D. Ward King		115 76
" 1	791	H. Krusekopf		8 30
" 1	792	S. H. Elkins		8 40
" 1	793	Columbia Telephone Co.		11 70
" 1	794	Pacific Express Co.		75
" 1	795	American Express Co.		1 25
" 1	796	S. H. Elkins		70 00
" 1	797	Geo. B. Ellis		50 00
" 1	798	C. M. Lewelling		167 60
" 1	799	H. J. Waters		37 50
" 1	800	Henry Steinmesch		50 00
" 1		To requisition	1,000 00	
Dec. 4	801	By A. E. Grantham		47 70
" 4	802	D. P. Ashburn		116 96
" 4	803	C. M. Lewelling		81 30
" 4	804	E. E. Laughlin		38 05
" 4	805	S. M. Jordan		205 88
" 4	806	J. W. Waller		80 00

FARMERS' INSTITUTE FUND—Continued.

Date.	War. No.	Name.	Dr.	Cr.
1906.				
Dec. 4......	807	T. E. Quisenberry..................	....	$200 00
" 4......	808	M. F. Miller..................	....	200 00
" 4......	809	W. A. Bright..................	....	20 00
" 4......	810	By Geo. B. Ellis..................	....	62 50
" 4......	811	Cloud & Savage..................	....	1 25
" 4......	812	C. D. Lyon..................	....	98 75
" 4......	813	J. B. Tiffany..................	....	1 62
" 4......	814	Bates County Democrat..........	....	1 50
" 4......	815	Butler Weekly Times..........	....	1 50
" 4......	816	P. E. Crabtree..................	....	61 92
" 4......	817	Western Union Co..............	....	10 47
" 4......	818	Smith Premier Co..............	....	12 35
" 4......	819	Columbia Printing Co..........	....	25 00
" 4......	820	C. F. Marbut..................	....	24 75
" 4......	821	Gilman & Dorsey..............	....	9 00
" 4......	822	L. F. Childers..................	....	82 29
" 4......	823	G. W. Williams..................	....	126 05
" 4......	824	F. B. Mumford..................	....	31 12
" 4......	825	C. H. Eckles..................	....	22 09
" 4......	826	J. C. Whitten..................	....	51 70
" 4......	827	D. Ward King..................	....	147 40
" 4......	828	S. H. Elkins..................	....	40 00
" 4......	829	C. C. Lockwood..................	....	6 90
" 4......	....	To requisition..................	2,300 00	
" 18......	....	By balance..................	....	1,518 84
			$7,669 51	$7,669 51

OFFICE EXPENSE FUND.

Date.	War. No.	Name.	Dr.	Cr.
1905.				
Dec. 19......	....	To balance..................	$103 33	
" 20......	575	By Columbia Typewriter Exchange...	....	$3 00
" 20......	576	Smith Premier Typewriter Co....	....	12 60
1906.				
Jan. 12......	577	Parker Furniture Co..............	....	31 50
" 12......	578	J. R. Ellis..................	....	16 05
" 12......	579	W. E. Harshe..................	....	2 30
" 12......	580	J. B. Rector..................	....	8 35
" 12......	581	W. A. Bright (transfer from old to new treasurer, $87.73)		
" 12......	....	To requisition..................	100 00	
Feb. 3......	582	By J. B. Rector..................	....	10 00
" 3......	583	J. R. Ellis..................	....	17 11
Mar. 6......	584	J. B. Rector..................	....	10 00
" 6......	585	Schooley Stationery Co..........	....	1 79
" 6......	586	J. R. Ellis..................	....	15 64
" 6......	587	R. L. Jenkins..................	....	1 25
" 6......	588	W. E. Harshe..................	....	2 95
April 4......	589	J. R. Ellis..................	....	16 35
" 4......	590	J. B. Rector..................	....	10 00
" 4......	591	Barnes-Crosby Co..............	....	3 15
May 1......	592	National Paper Co..............	....	10 68
" 1......	593	J. B. Rector..................	....	10 00
" 1......	594	J. R. Ellis..................	....	16 30
" 1......	595	Columbia Statesman..............	....	3 00
" 1......	596	Parker Furniture Co..............	....	40 00
" 1......	....	To requisition..................	100 00	

OFFICE EXPENSE FUND—Continued

Date.	War. No.	Name.	Dr.	Cr.
1906.				
June 6......	597	By B. W. Tillman................	....	$9 25
" 6......	598	G. T. Tooms....................	....	5 00
" 6......	599	J. B. Rector....................	....	10 00
" 6......	600	M., K. & T. R. R. Co...........	....	2 45
" 6......	601	J. R. Ellis......................	....	4 00
" 6......	602	National Paper Co...............	....	27 50
" 6.....	603	Wabash R. R. Co..................	....	2 44
" 6......	604	Columbia Statesman..............	....	2 50
" 6......	....	To requisition....................	$100 00	
July 2.....	605	By Kampmeyer & Wagner.........	....	4 40
" 2......	606	Barnes-Crosby Co................	....	8 63
" 2......	607	Barnes-Crosby Co................	....	25 58
" 2......	608	C. W. Prier......................	....	10 00
" 2......	609	G. T. Tooms.....................	....	5 00
" 2......	610	J. B. Rector.....................	....	10 00
" 2......	611	National Paper Co................	....	8 02
" 2......	....	To requisition.....................	100 00	
Aug. 4......	612	By W. E. Harshe.................	....	4 05
" 4......	613	Columbia Printing Co.............	....	7 50
" 4......	614	C. W. Prier......................	....	10 00
" 4......	615	G. T. Tooms.....................	....	5 00
" 4......	616	J. B. Rector.....................	....	10 00
" 4......	617	Nifong Mfg. Co..................	....	4 75
Sept. 4......	618	Smith Premier Co................	....	3 00
" 4......	619	National Paper Co................	....	9 18
" 4......	620	G. T. Tooms.....................	....	5 00
" 4......	621	J. B. Rector.....................	....	10 00
" 4......	622	Lemuel Crouch...................	....	12 48
" 4......	623	W. E. Harshe....................	....	6 75
Oct. 2......	624	J. B. Rector.....................	....	10 00
" 2......	625	G. T. Tooms.....................	....	5 00
" 2......	626	Jas. L. Hall......................	....	3 75
" 2......	627	Barnes-Crosby Co................	....	1 95
" 2......	628	M., K. & T. R. R................	....	1 27
" 2......	629	Pacific Express Co...............	....	80
" 2......	630	Strawn & Holland D. G. Co.......	....	2 25
" 2......	631	Columbia Typewriter Exchange....	....	35 22
" 2......	632	J. R. Ellis.......................	....	11 12
" 10......	633	W. E. Harshe....................	....	2 20
" 2......	....	To requisition.....................	100 00	
Nov. 1......	634	By J. B. Rector..................	....	18 35
" 1......	635	J. R. Ellis.......................	....	17 37
" 1......	636	F. M. Joy........................	....	3 87
" 1......	....	To requisition.....................	100 00	
Dec. 4......	637	By T. D. Murphy.................	....	1 25
" 4......	638	Alex Stewart.....................	....	6 50
" 4......	639	J. R. Ellis.......................	....	16 67
" 4......	640	J. B. Rector.....................	....	18 35
" 18......	....	By balance.......................	....	82 91
			$703 33	$703 33

STATE VETERINARY FUND.

Date.	War. No.	Name.	Dr.	Cr
1905.				
Dec. 19		To balance	$609 66	
" 20	1719	By H. H. Banks		$55 00
" 20	1720	Columbia Telephone Co		9 60
" 20	1721	S. H. Elkins		21 20
" 20	1722	Western Union Telegraph Co		4 23
" 20	1723	Horace Bradley		15 10
" 20	1724	R. B. Love		27 50
" 20	1725	H. V. Goode		21 75
" 20	1726	I. H. Collier		101 25
" 20	1727	J. W. Connaway		8 38
" 20	1728	L. D. Brown		18 60
" 20	1729	H. M. McConnell		4 50
1906.				
Jan. 12	1730	R. C. Moore		36 00
" 12	1731	D. F. Luckey		192 74
" 12	1732	Stanley Smith		27 85
" 12	1733	I. H. Collier		70 25
" 12	1734	Horace Bradley		19 55
" 12	1735	H. V. Goode		12 60
" 12	1736	D. F. Luckey		101 02
" 12	1737	N. K. Hall		50 00
" 12	1738	W. A. Bright (transfer from old to new treasurer $349.15)		
" 12		To requisition	$1,000 00	
Feb. 3	1739	By L. D. Brown		37 45
" 3	1740	J. W. Connaway		29 88
" 3	1741	Western Union Telegraph Co		3 61
" 3	1742	R. C. Moore		49 10
" 3	1743	N. K. Hall		50 00
" 3	1744	R. P. Poage		48 10
" 3	1745	Stanley Smith		44 35
" 3	1746	D. F. Luckey		228 55
" 3	1747	F. W. O'Brien		61 03
" 3	1748	Horace Bradley		20 05
" 3		To requisition	500 00	
Mar. 6	1749	By J. H. Slater		9 33
" 6	1750	Stanley Smith		6 80
" 6	1751	T. E. White		9 15
" 6	1752	R. P. Poage		56 50
" 6	1753	H. H. Wolf		9 00
" 6	1754	Samuel Sheldon		28 00
" 6	1755	Pacific Express Co		4 84
" 6	1756	F. W. O'Brien		12 50
" 6	1757	H' V. Goode		14 60
" 6	1758	R. C. Moore		20 00
" 6	1759	N. K. Hall		50 00
" 6	1760	H. V. Goode		41 15
" 6	1761	Columbia Statesman		5 00
" 6	1762	S. H. Elkins		42 00
" 6	1763	W. R. Jenkins		2 50
" 6	1764	L. D. Brown		70 88
" 6	1765	R. L. Allen		91 80
" 6	1766	D. F. Luckey		174 70
" 6		To requisition	500 00	
April 4	1767	By R. L. Allen		173 38
" 4	1768	Columbia Telephone Co		10 10
" 4	1769	N. K. Hall		50 00
" 4	1770	Western Union Telegraph		3 29
" 4	1771	R. C. Moore		15 00
" 4	1772	Jas. Cullison		24 98
" 4	1773	L. D. Brown		64 86
" 4	1774	F. W. O'Brien		16 20

STATE VETERINARY FUND—Continued.

Date.	War. No.	Name.	Dr.	Cr.
1906.				
April 4	1775	S. H. Elkins		$15 00
“ 4	1776	D. F. Luckey		192 82
“ 4		To requisition	$1,000 00	
May 1	1777	By Samuel Sheldon		52 03
“ 1	1778	N. K. Hall		50 00
“ 1	1779	By R. L. Allen		186 71
“ 1	1780	L. D. Brown		18 84
“ 1	1781	J. H. Slater		7 34
“ 1	1782	F. W. O'Brien		15 55
“ 1	1783	S. H. Elkins		14 00
“ 1	1784	D. F. Luckey		186 55
June 6	1785	J. W. Connaway		17 44
“ 6	1786	Western Union		1 33
“ 6	1787	H. F. Boettner		34 22
“ 6	1788	Stanley Smith		9 30
“ 6	1789	R. C. Moore		97 50
“ 6	1790	H. V. Goode		29 95
“ 6	1791	H. H. Wolf		16 00
“ 6	1792	Columbia Telephone Co.		7 00
“ 6	1793	N. K. Hall		50 00
“ 6	1794	D. F. Luckey		284 75
“ 6	1795	S. H. Elkins		5 50
“ 6	1796	W. J. Ward		10 00
“ 6	1797	E. M. Hendy		17 25
“ 6	1798	R. L. Allen		198 32
“ 6	1799	T. E. White		5 85
“ 6	1800	Pacific Express Co.		7 04
“ 6	1801	Western Union Telegraph Co.		1 94
“ 6	1802	Horace Bradley		19 45
“ 6	1803	Stanley Smith		17 35
“ 6	1804	Columbia Statesman		2 00
“ 6	1805	L. D. Brown		66 20
“ 6	1806	James Cullison		8 88
“ 6		To requisition	1,000 00	
July 2	1807	By D. F. Luckey		196 22
“ 2	1808	Western Union		2 21
“ 2	1809	L. D. Brown		63 27
“ 2	1810	Jas. Cullison		26 32
“ 2	1811	R. L. Allen		205 35
“ 2	1812	J. H. Slater		19 53
“ 2	1813	R. C. Moore		10 00
“ 2	1814	N. K. Hall		50 00
“ 2		To requisition	1,000 00	
Aug. 4	1815	By Eloise Kneisley		16 20
“ 4	1816	N. K. Hall		3 85
“ 4	1817	W. F. Berry		9 90
“ 4	1818	R. B. Love		18 03
“ 4	1819	W. A. Bright		25 00
“ 4	1820	Stanley Smith		16 40
“ 4	1821	Horace Bradley		35 55
“ 4	1822	Western Union		1 40
“ 4	1823	J. W. Connaway		17 05
“ 4	1824	R. L. Allen		125 00
“ 4	1825	Tilley & Hatton		6 00
“ 4	1826	R. C. Moore		40 00
“ 4	1827	S. H. Elkins		18 00
“ 4	1828	J. H. Slater		8 53
“ 4	1829	Horace Bradley		22 90
“ 4	1830	F. W. O'Brien		44 82
“ 4	1831	S. Sheldon		21 26
“ 4	1832	D. F. Luckey		205 99
“ 4		To requisition	1,000 00	

STATE VETERINARY FUND—Continued.

Date.	War. No.	Name.	Dr.	Cr.
1906.				
Sept 4	1833	By Eloise Kneisley		$8 77
" 4	1834	R. L. Allen		276 65
" 4	1835	Columbia Statesman		5 50
" 4	1836	H. V. Goode		32 77
" 4	1837	Columbia Tribune		3 00
" 4	1838	Columbia Telephone Co		7 95
" 4	1839	R. C. Moore		65 95
" 4	1840	B. H. Hawkins		40 00
" 4	1841	D. F. Luckey		227 30
" 4	1842	By Western Union		$1 27
" 4	1843	S. H. Elkins		35 00
" 4	1844	E. Brainerd		8 25
" 4	1845	S. H. Elkins		21 20
Oct. 2	1846	B. H. Hawkins		40 00
" 2	1847	S. H. Elkins		10 90
" 2	1848	Columbia Typewriter Ex		42 88
" 2	1849	Horace Bradley		18 45
" 2	1850	S. H. Elkins		3 00
" 2	1851	L. D. Brown		48 16
" 2	1852	H. F. Boettner		49 18
" 2	1853	D. F. Luckey		233 71
" 2	1854	R. C. Moore		58 70
" 2		To requisiton	$1,000 00	
" 10	1855	By Jas. Cullison		48 62
" 10	1856	R. B. Love		107 15
" 10	1857	R. L. Allen		218 60
" 10	1858	Mabel Bailey		4 37
" 10	1859	Pacific Express Co		12 18
Nov. 1	1860	D. F. Luckey		205 48
" 1	1861	Horace Bradley		6 22
" 1	1862	Eloise Kneisley		1 87
" 1	1863	B. H. Hawkins		40 00
" 1	1864	S. H. Elkins		7 00
" 1	1865	R. C. Moore		30 00
" 1	1866	S. H. Elkins		45 00
" 1	1867	F. W. O'Brien		16 54
" 1	1868	H. V. Goode		22 85
" 1	1869	R. L. Allen		195 00
" 1		To requisition	1,000 00	
Dec. 4	1870	By R. L. Allen		176 55
" 4	1871	Jas. Cullison		209 93
" 4	1872	Stanley Smith		16 90
" 4	1873	R. C. Moore		17 50
" 4	1874	S. Sheldon		90 35
" 4	1875	Parker Furniture Co		47 75
" 4	1876	R. B. Love		135 63
" 4	1877	Jas. Cullison		140 74
" 4	1878	Strawn-Holland D. G. Co		27 60
" 4	1879	Pacific Express Co		4 68
" 4	1880	W. F. Berry		16 40
" 4	1881	D. F. Luckey		264 28
" 4	1882	Horace Bradley		26 05
" 4	1883	F. I. Vandeventer		6 25
" 4	1884	S. H. Elkins		2 00
" 4	1885	W. A. Bright		25 00
" 4	1886	B. H. Hawkins		40 00
" 4		To requisition	1,400 00	
" 18		By Balance		1,331 89
			$10,009 66	$10,009 56

SUMMARY OF SECRETARY'S FINANCIAL STATEMENT.

Printing and Distributing Annual Report Fund.

Date.		Dr.	Cr.
December 19, 1905...	To balance in State Treasury................	$3,937 79	
December 19, 1905...	To balance in Treasury Board of Agriculture..	0,000 00	
December 19, 1905, to December 18, 1906.	By warrants drawn on Treasurer Board of Agriculture..................................	....	$807 61
December 18, 1906...	By balance in State Treasury................	....	3,130 08
	By overdraft Treasurer Board of Agriculture..	....	.10
		$3,937 79	$3,937 79

Monthly Crop Report Fund.

December 19, 1905...	To balance in State Treasury................	$1,200 00	
December 19, 1905...	To balance in Treasury Board of Agriculture..	125 39	
December 19, 1905, to December 18, 1906.	By warrants drawn on Treasurer Board of Agriculture..................................	....	$757 08
December 18, 1906...	By amount paid for printing monthly bulletins, account with printing commission	....	286 21
December 18, 1906...	By balance Treasury Board of Agriculture..	....	68 31
December 18, 1906...	By balance State Treasury...............	....	213 79
		$1,325 39	$1,325 39

Expense of Members Fund.

December 19, 1905...	To balance in State Treasury................	$800 00	
December 19, 1905...	To balance Treasury Board of Agriculture....	396 25	
December 19 1905, to December 18, 1906	By warrants drawn on Treasurer Board of Agriculture..........................	....	$915 23
December 18, 1906...	By balance in Treasury Board of Agriculture	....	281 02
		$1,196 25	$1,196 25

Farmers' Institute Fund.

December 19, 1905...	To balance in State Treasury................	$7,300 00	
December 19, 1905...	To balance Treasury Board of Agriculture....	369 51	
December 19, 1905, to December 18, 1906.	By warrants drawn on Treasurer Board of Agriculture..........................	....	$6,150 67
December 18, 1906...	By balance Treasury Board of Agriculture...	....	1,518 84
		$7,669 51	$7,669 51

Office Expense Fund.

Date.		Dr.	Cr.
December 19, 1905...	To balance State Treasury..................	$600 00	
December 19, 1905...	To balance Treasury Board of Agriculture....	103 33	
December 19, 1905 to December 18, 1906.	By warrants drawn on Treasurer Board of Agriculture........................	....	$620 42
December 18, 1906...	By balance Treasury Board of Agriculture...	....	82 91
		$703 33	$703 33

State Veterinary Fund.

December 19, 1905...	To balance State Treasury..................	$10,200 00	
December 19, 1905..	To balance Treasury Board of Agriculture....	609 66	
December 19, 1905 to December 18, 1906	By warrants drawn on treasurer Board of Agriculture.........................	....	$8,677 77
December 18, 1906...	By balance Treasury Board of Agriculture..	....	1,331 89
December 18, 1906..	By balance State Treasury................	....	800 00
		$10,809 66	$10,809 66

The above report is a true copy of the records of this office.

GEO. B. ELLIS, Secretary.

Treasurer's Report.

To the State Board of Agriculture:

I, W. A. Bright, Treasurer of the Board of Agriculture, submit the following report of the amount of money received from H. H. Banks, your former treasurer, and from the State Treasurer, including balances, and the amounts paid out on warrants presented against the several funds of the Board of Agriculture, and the balances now on hand, all for the year ending December 17, 1906:

Printing of Annual Report.

Date.		Dr.	Cr.
May 8	To State warrant	$300 00	
August 8	State warrant	300 00	
September 13	State warrant	207 51	
December 17	Overdraft	10	
December 17	By warrants paid and cancelled		$807 61
		$807 61	$807 61

Monthly Crop Report.

January 13	To funds transferred from former Treasurer	$117 89	
March 9	State warrant	100 00	
April 6	State warrant	200 00	
June 11	State warrant	100 00	
August 8	State warrant	100 00	
September 13	State warrant	100 00	
December 11	State warrant	100 00	
December 17	By warrants paid and cancelled		$714 96
December 17	balance		102 93
		$817 89	$817 89

Expense of Members' Fund.

January 13	To funds transferred from former Treasurer	$265 13	
January 18	State warrant	200 00	
March 9	State warrant	100 00	
August 17	State warrant	200 00	
October 20	State warrant	100 00	
December 11	State warrant	200 00	
December 17	By warrants paid and cancelled		$784 11
December 17	balance		281 02
		$1,065 13	$1,065 13

Farmers' Institute Fund.

Date.		Dr.	Cr.
January 13	To funds transferred from former Treasurer	$532 65	
January 18	State warrant	500 00	
February 8	State warrant	500 00	
April 6	State warrant	500 00	
August 8	State warrant	500 00	
October 8	State warrant	1,000 00	
November 8	State warrant	1,000 00	
December 11	State warrant	2,300 00	
December 17	By warrants paid and cancelled		$4,494 24
December 17	balance	2,338 41	
		$6,832 65	$6,832 65

Office Expense Fund.

January 13	To funds transferred from former Treasurer	$87 73	
January 18	State warrant	100 00	
May 8	State warrrant	100 00	
June 11	State warrant	100 00	
July 11	State warrant	100 00	
October 8	State warrant	100 00	
November 8	State warrant	100 00	
December 17	By warrants paid and cancelled		$604 82
December 17	balance		82 91
		$687 73	$687 73

State Veterinary Fund.

January 13	To funds transferred from former Treasurer	$349 15	
January 18	State warrant	1,000 00	
February 8	State warrant	500 00	
March 9	State warrant	500 00	
April 6	State warrant	1,000 00	
June 9	State warrant	1,000 00	
July 11	State warrant	1,000 00	
August 8	State warrant	1,000 00	
October 8	State warrant	1,000 00	
November 8	State warrant	1,000 00	
November 11	State warrant	1,400 00	
December 17	By warrants paid and cancelled		$8,366 46
December 17	balance		1,382 69
		$9,749 15	$9,749 15

Respectfully submitted,

W. A. BRIGHT, Treasurer.

Report of State Veterinarian.

Mr. President and Gentlemen of the Board of Agriculture:

With the exception of a wide-spread outbreak of sheep scabies in Laclede county and Texas fever in parts of Jasper, Newton and McDonald counties, the control work by the Veterinary Department has been about the same during 1906 as in former years. Aside from attending to outbreaks of glanders and other diseases which require more or less attention every year in all of the states, this department has undertaken to completely stamp out sheep scabies and Texas fever, and an unusual number of tuberculin tests of beef and dairy cattle have been made during the year. The tables in another part of the annual report will show in detail the work done by regular deputies. In addition to the work shown by the tables, and aside from attending to work at the office, I have given my personal attention to testing cattle with tuberculin, and have spent a considerable part of my time in attending farmers' institutes and other educational work.

Although not requiring much of my time, the work of registration of the veterinarians of the State has been completed, and it might be of interest to the Board to know something of the results of the registration. The Veterinary Practice Act, which made it unlawful for anyone to practice veterinary surgery after the first day of January, 1906, without a license, provided for the registration of veterinarians on three conditions. Section 2 provided for the registration of anyone who had practiced in the State for a livelihood for three years prior to January 1, 1906, regardless of the qualifications of the applicant. Under this section 265 persons registered, many of whom are by no means qualified to practice. The privilege of registration under this section was provided on account of a decision rendered by the Supreme Court in connection with a medical act, in which it was held that to deprive a man of the right of earning a livelihood by his usual vocation was unconstitutional. Section 3 of the Veterinary Act provided for the registration of anyone who was a graduate of a regularly chartered veterinary college at the time the act went into effect. Under this section 164 persons were registered. Nearly all of the veterinarians registered under section 3 are competent men. Some few, however, among this number secured diplomas from colleges which did not maintain a thorough course of instruction. Section 4 of the Veterinary Act provided for the registration of anyone after January 1, 1906, only on condition that he pass a satisfactory examination before the Veterinary Board. Under this section 37 persons have been registered. The examinations have all been held in writing. The questions have consisted of ten each on the subjects of theory and practice, medicine and surgery, and were so framed that their correct answer would require a knowledge on the part of the applicant of pathology, physiology and anatomy. All applicants have been required to make 70 per cent on each set of questions. While the Veterinary Examining Board has endeavored to make all examination questions extremely practical, one or more applicants from each college represented so far has failed to pass. The papers of all of those who failed, enclosing in the handwriting of the applicant the questions which he attempted to answer, have been placed on file for reference, in case of dispute. I will add further that it has been the custom of the Veterinary Board to require each applicant for examination to sign his name to a secret list opposite some number which he used on his paper during the examination, and that all papers have been graded and the applicant passed upon, as far as possible, without a personal knowledge, upon the part of the Board, of whose application it had under consideration. In dealing with all applicants, the Board has made every effort to be impartial.

Anticipating enough extra work to keep one busy, I advised the Board, at a meeting February 10th, to employ a deputy veterinarian for constant work. Following this recommendation, the Executive Committee employed Dr. R. L. Allen, a graduate of the Kansas City Veterinary College, who at the time was in the federal meat inspection service. Dr. Allen began work February 15th and was employed until March 30th in making tuberculin tests of dairy cattle. From March 30th to May 15th he was employed in Laclede county in hunting up and quarantining sheep affected with scabies. From May 15th to June 15th he was again employed in making tuberculin tests. From June 20th to December 1st he was employed in Southwest Missouri in the work of stamping out Texas fever.

During the time he spent in Laclede county, Dr. Allen placed in quarantine 129 bunches of sheep, including a total of 2,999 head. which he found affected with scabies. At the time of serving the quarantine notice, the owner of the sheep was supplied with written directions for the preparation and use of the lime and sulphur and the tobacco and sulphur dips, and instructed to use either one of the dips twice at intervals of nine to eleven days, and that his sheep would be released from quarantine on an affidavit stating in what manner he had complied with these directions. All of the sheep placed in quarantine were released by Dr. Allen, by notice sent through the mail, on receipt of the proper affiidavit. On December 1st Dr. Allen returned to Laclede county and remained until the 15th. During this time he re-examined, as far as possible, the sheep which he had placed in quarantine. One thousand and seventy of these sheep were re-examined and all found free from scabies. The control of sheep scabies in Laclede county seems to be well in hand, and except for infected bunches, which were not found during the last spring, there seems little likelihood of any further trouble from this disease. The infected sheep were scattered over such a territory that it is barely possible that all of the diseased sheep have been located. In case of any indications of scabies in any part of that section of the State, its control will be promptly undertaken.

In his work in Southwest Missouri from June 20th to December 21st, Dr. Allen had instructions as follows: To place in quarantine in dry lots all cattle found carrying fever ticks; to authorize the transfer of infested cattle from one pasture to another only after a thorough hand dressing of oil; to release such cattle from quarantine only when they had been personally examined and found free from fever ticks, and then on condition that they be removed to pastures or ranges which were not infested with ticks; and to quarantine all tick-infested pastures, forbidding their use for horses or cattle from date of quarantine to December 1st. During the time that Dr. Allen was engaged in this work he placed in quarantine 14 pastures and 164 lots of cattle, including 1,719 head. Up to December 1st, 51 bunches, including 1,248 head of cattle, were disinfected and released from quarantine. On December 1st, 113 lots, including 471 head of cattle, still remained in quarantine. A good number of those still in quarantine had been disinfected, but were not released on account of the fact that no convenient place, free from ticks, was found in which to turn them. The remaining 471 head were released from quarantine December 20th by notices sent through the mail. These cattle were released from quarantine from the fact that the cold weather makes it improbable that they will spread any infection. The work of eradicating fever ticks will be renewed early in the spring, and every effort made to completely stamp them out of the State during the coming year. In this connection it might be well to state that an unusual number of violations of the federal quarantine law was largely responsible for the increased number of tick-infested cattle in this State during the past year. Being a matter of interstate commerce, the enforcement of the quarantine line on the southern border of this State has been left to the federal department. The work of enforcing it during the past year, by the federal department, has been very desultory, to say the least. As far as can be learned, no inspector has been assigned to any part of the line and allowed to remain on it long enough to get acquainted with the territory in which he worked. At least, quite a number of violations of the federal quarantine law have occurred, definite facts concerning which have been reported to this office. These violations occurred not only in Southwest Missouri, but in the vicinity of Taney and Ozark counties, and one shipment of ticky cattle originated at Mountainview, in Howell county. The spread of fever ticks became quite extensive in Ripley county, but their introduction was undoubtedly not due to quarantine violations. Every indication points to the fact that they were carried into the vicinity of Doniphan on western horses.

Of the contagious diseases with which this department has to deal, tuberculosis of cattle is of vastly more importance than any other one disease, and probably more than all others put together. The proper control of tuberculosis in cattle in the future will require an unlimited amount of work by this department. In August, 1905, a bulletin was issued explaining the tuberculin test and offering the services of the Veterinary Department of this State to the owner of any permanent herd in making an examination of his cattle. Before this bulletin was issued there were some tests made, and as a result of the offer a number of applications were received at this office. Altogether 51 herds, including 1,405 animals, have been tested; 129 head of cattle were found diseased with tuberculosis in 15 of these bunches. These tests were confined to registered beef herds and grade dairy herds, to which registered animals were being added with a view of improving the herd. In tests of registered beef cattle, tuberculous animals were found coming directly from six prominent registered herds of this State, which have not yet been examined. On August 23rd, out of a shipment of 55 hogs to Kansas City, Mo., 23 head were condemned on account of tuberculosis. I traced these hogs back to their origin, and found that they came from a farm on which a large herd of registered Shorthorns was propagated, and on the premises I found the skeletons of cattle from which the hogs had eaten the flesh. I had had unofficial knowledge of the existence of tuberculosis in this herd for three or four years. Individual animals from this herd can now be found in many prominent herds of the State. This is mentioned as an example to show the situation in regard to tuberculosis among the beef breeds. Tuberculosis was found prevalent in the dairy herds in St. Louis county, where dairying has been carried on for a great number of years. In one herd, as an extreme example, 27 cows and heifers, out of 78 head, were found diseased with tuberculosis. One cow, showing the most doubtful reaction from the test, was slaughtered, and plain lesions discovered in the glands of the throat. Later in the summer another cow, which had gone down rapidly from tuberculosis, was killed and found badly diseased in the udder and throughout the internal organs. A quarter of this cow's udder, in which was found a tubercular abscess with a fistulous tract alongside of the teat, was brought to the Experiment Station and preserved for future reference. Of the reacting cows probably 20 head were giving milk; five of these showed marked signs of tuberculosis. A notice, placing all of the diseased cattle in quarantine, was served on the owner, who is an ex-member of the Board of Agriculture, on March 17th. Since that time the owner of the herd has continued to ship milk from the diseased cows to St. Louis, where it is mixed with the general milk supply. The tests of dairy cattle have been carried far enough that we are able to state positively that the milk supply of St. Louis, Kansas City and St. Joseph is contaminated with the milk from tuberculous cows.

At a meeting of the Executive Committee, June 6, 1906, the State Veterinarian was ordered to make an investigation of the slaughter house conditions of this State and report the same to the Board. The investigation was duly made and a report rendered to the Executive Committee at a meeting at the State Fair, October 6th. The results of the investigation developed some very important facts, which may be summed up as follows: At public expense, the Federal government is furnishing meat inspection to all packing plants doing an interstate business. The principal part of the interstate business is done by the four large packing firms usually referred to as the packing trust. These powerful financial institutes are getting the benefit of free meat inspection, and their products are now being given the preference in all the markets of the world. Some of these firms are filling magazines and newspapers with glaring advertisements, giving prominence to the fact that they are selling inspected products. Numerous retail shops in the large cities are posting signs stating that nothing but U. S. inspected meat is sold. The federal inspection stamp on dressed meats is a guarantee to the public of its wholesomeness and healthfulness. The system of inspection provided for by the federal government gives those firms engaged in interstate commerce a great prestige over the smaller packers, and the indications are that this will be the greatest possible stimulus in favor of a meat trust. The public is now aware of the necessity of a thorough inspection of live animals and dressed meat, and there is no possibility of the discontinuance of federal meat inspection. It now devolves upon this State to provide, as far as possible, inspection of meats for everyone engaged in the butcher business in this State. The only way to meet the competition of the trust packing houses is for independent firms to provide meats equal in quality to theirs. It seems that this State now has a golden opportunity for providing inspection and offering other protections to the independent packer to encourage the extension of a number of thrifty independent firms. The result will naturally be a greater number of markets for live stock and a greater number of sources of meat supply, amounting altogether to a wholesome competition in the meat business. If the opportunities which are now at hand are neglected, the independent packer will have a slim chance for existence. The proposition before the Board is simply as to whether or not the independent plants in operation in this State shall be sustained and encouraged and others like them brought into existence, or whether the situation shall be let alone and slowly, but surely, resulting in the extinction of the independent packing houses.

In order to accomplish what should be done, four acts by the State Legislature and one by the Board of Agriculture will be necessary. The first piece of legislation necessary is an act to prescribe a standard of cleanliness for country slaughter houses. This act ought to provide that every country slaughter house should be cleaned and disinfected after each killing, and forbid any offal of any kind to be left within 200 yards of any slaughter house to decay or to be eaten by hogs. If such an act were put into force, the public would feel more secure in regard to the quality of meat dressed in country slaughter houses. Most of the diseased food animals are shipped to the public markets; there is too much chance of detection for the country butcher to use diseased animals to any great extent. It is well known that some country butchers make a practice of slaughtering diseased cattle and hogs, but this practice is very limited, and if the law requiring cleanliness in the country slaughter house was faithfully enforced, little fault could be found with the meat slaughtered therein.

Another act of the Legislature necessary is one giving cities more authority in providing meat inspection. The present statutes only provide for cities to inspect the live animal. This statute should be extended to give any city authority to inspect and condemn meats at the time of slaughter and to regulate the cleanliness and disinfection of the plant. The statute ought to be so comprehensive as to provide cities with authority to establish a central public abattoir, and require all local slaughtering to be done there.

Another important act of the Legislature necessary is one providing for State control of "out of condition" animals at the public stock yards. The federal yard inspectors have authority to control only such animals as are affected with or capable of spreading a contagious disease. There are many conditions, aside from contagious diseases, which render an animal unfit for food and for which their carcasses are condemned by federal meat inspectors. Such animals are referred to as "out of condition." Some of these are affected with non-contagious diseases, and some are unfit for food simply on account of such things as advanced pregnancy, too recent parturition and being too young. The federal meat inspectors have no authority over these animals until they are purchased by a packer engaged in interstate trade and are within the abattoir pens. At the St. Louis, St. Joseph and Kansas City yards there are received altogether probably 1,000 head per week of this class of food animals. Unscrupulous butchers are now engaged in driving them from the public stock yards to slaughter. Unless prohibited by State law, this practice is likely to increase rapidly. The results are that the public is imposed upon with unfit meat, and the few who are engaged in this traffic are doing a great deal to injure the reputation of meats from all sources not covered by inspection. The State ought to provide inspectors at once, to be stationed at all of the public stock yards in this State, with authority to control "out of condition" animals, and require them to be slaughtered, if at all, under competent inspection, where their carcasses would be permitted to be used for only such purposes as they were found fit. If any difficulty is found in making the provisions under the law necessary to obtain the desired end, the matter can be disposed of by a law requiring a permit from a State inspector for the removal of each animal from the public stock yards. Permits for the removal of unsound animals may then be refused by the inspector in charge.

Still another piece of legislation which, from my investigation, I think would be of immense benefit toward encouraging independent packers, is a law requiring all packing plants to quote meat f. o. b. the same price for all points in the State. In any town where an independent packing firm attempts to operate to any extent, meat is sold by the trust packing houses much cheaper than the same quality is sold in other towns of the State. At Sedalia and Webb City, for instance, where independent firms are operating, the carcasses of beef, in quality known as dressed beef, are sold by the trust packing houses for about the same price they charge in other towns of the State for a lower quality of meat known as "butcher" stuff. This practice makes it next to impossible for any independent firm to do a profitable packing business. There is no assurance that an independent packer will not be closed out of business by such competition at any time. Under these conditions, it is unsafe for any independent firm to invest much money in a packing plant. The law ought to provide that meat of any given quality should be quoted to all towns of this State at the same price. If this law is avoided by substituting meat of a higher quality in those towns where there is independent competition, the law ought to provide for federal inspectors at the packing plants to grade the meats, so that evasion of the law by this plan would not be possible.

The act of the Board of Agriculture, which will help a great deal along the line of promoting independent packing houses, is to pass an order making it a policy of the Board to extend to any independent packing firm or city abattoir the privilege of handling southern cattle for immediate slaughter. This can be done with absolute safety. At Kansas City alone, in the year 1905, there were received in the southern pens for immediate slaughter 332,000 head of cattle. Out of this number, those that are classed as butcher stuff, sell for about 50 cents per hundred less in the southern pens than cattle of the same quality in native pens. This is equivalent to $5.00 per head for every 1,000-pound steer. The trust packing houses only have access to cattle in the southern pens. The independent packers must buy in the native pens or in markets controlled by them. The privilege of dealing in southern cattle extended to the independent packer will do a great deal toward his success.

On account of a limited outbreak of mange in Worth county and scabies among sheep in Lewis county, I wish to recommend for appointment as deputies Dr. J. H. McElroy of Grant City and Dr. T. F. Arnold of Lewistown.

Respectfully submitted,
D. F. LUCKEY,
State Veterinarian

Farmers' Week in Agricultural College

January 7-12, 1907.

Fourth Annual Meeting Missouri Corn Growers' Association, Tenth Annual Meeting Missouri Improved Live Stock Breeders' Association, Seventeenth Annual Meeting Missouri State Dairy Association and First Annual Meeting Missouri State Sheep Breeders' Association.

(Held under the auspices of the State Board of Agriculture.)

Abstract of the Addresses Delivered.

OPENING SESSION.

Farmers' week in the Agricultural College has grown to be the annual event for the farmers of the State. The first meeting was held in the Agricultural College in January, 1904, with only one organization assisting the State Board of Agriculture—namely, the Improved Live Stock Breeders' Association, and at that time the Missouri Corn Growers' Association was organized. The second Farmers' Week Convention was participated in by the Improved Live Stock Breeders' Association and the Corn Growers' Association, with a much better interest and a larger attendance. The third meeting held in the Agricultural College, January, 1906, was participated in by the above-named conventions, with an attendance about twice as large as the year before. The fourth annual meeting was participated in by the Improved Live Stock Breeders' Association, the State Corn Growers' Association, the State Sheep Breeders' Association and the Missouri State Dairy Association, with the largest attendance and greatest enthusiasm of any meeting yet held. The farmers of the State are just beginning to realize that the Agricultural College is their school, and that it is profitable to visit the college at least once a year. It is hoped to make the college the home of all State farmers' associations, giving the members of the different associations an opportunity to meet and get acquainted with each other, as well as to meet the members of the State Board of Agriculture and the faculty of the Agricultural College, and to visit the State Experiment Station and observe the experiments which are being carried on. The State Corn Show has become a fixed feature of these conventions, and at the last meeting prizes, aggregating nearly $1,000, were given for the best exhibits of corn. The first State boys' corn growing contest was held this year, boys receiving prizes from the State Board of Agriculture amounting to $200, and from the Commercial Club of Columbia to the amount of about $150. The boys' corn growing contest will be the principal feature of the meeting to be held in 1908.

ADDRESS OF WELCOME ON BEHALF OF STATE UNIVERSITY.

(Hon. Walter Williams, Member Board of Curators.)

It is my pleasure, Mr. President and gentlemen, to add a word to what the city government, through the president of the council, has said to you in the way of welcome.

I recognize the inability on my part to follow two Christian preachers, and one a city councilman as well. I have always hesitated in speaking to an audience of farmers. It would seem natural that a man, after asking thirteen or fourteen or fifteen farmers for their daughters, should get used to it. (Applause.) But the first time he does a thing of that kind it is very embarrassing, and he hesitates always thereafter when he speaks in the presence of one or more farmers.

In the name of President Jesse, whose regrettable illness gives me place here in his stead, in the name of the Board of Curators, of the faculty and of the students, I bid you welcome.

This is your University, if you are Missourians. It is here to serve all the people of all the State, as that which Missouri builds or bears or adopts should ever serve all the people of all the State. If you will note, on yonder portico you will see as the central ornament of this great building the central building of the University quadrangle and campus, the great seal of the commonwealth, which says to all Missourians that the welfare of the people is the supreme law of this University as of the commonwealth of which it is the chief school.

It rests, as all Missouri rests, upon the broad and liberal support of the men who make the real wealth of this agricultural State. Five per cent of the students here come from the homes of lawyers, and about five per cent come from the homes of physicians, and about eleven per cent come from the homes of merchants in the towns; but nearly forty per cent of the students here, in the college of mines, and in the college of law, and in the college of education, and in the college of medicine, and in the college of engineering, and in the college of agriculture, and in the college academic come from the homes of farmers in this State—nearly forty per cent of the students enrolled in the seven colleges which make the University of today. These are your children and this is your child.

May your coming here be an inspiration unto them and may it be pleasant and profitable unto you. May the education which they gain within these colleges make of these students worthier children of your homes and better fit for the duties of the highest citizenship in this great commonwealth.

I bid you welcome. The doors of the State's chief school swing open to you; the latch string is out to that which is yours and mine and all Missourians. Mr. President and gentlemen, I bid you welcome. (Applause.)

SPEECH IN RESPONSE TO ADDRESS OF WELCOME.

Dr. H. J. Waters, Dean Missouri Agricultural College.)

Ladies and Gentlemen: It is impossible for me to appropriately and properly represent a man of Governor Colman's ability as a speaker even if I had unlimited time for preparation. It is, therefore, still more inappropriate for me to attempt to represent him without notice or preparation.

But speaking for the State Board of Agriculture, under whose auspices this meeting is held, it may be worth while to say something about the work of this department of the State, about its place in the commonwealth, and the relation it bears to the work of the College of Agriculture and of the University. In the popular mind there is not a clear distinction between the State Board of Agriculture and the College of Agriculture. This comes about because of the fact that the State Board of Agriculture is, by the law of the State, quartered in the agricultural building, and because of the further fact that the two lines of work are very similar, and that the Board of Agriculture and College of Agriculture have been engaged in not only somewhat similar work, but have been parallel and have in some small degree overlapped. I do not mean to create the impression that there is any duplication in this, nor that there is any lost motion or any waste effort.

For in all the years that the Board of Agriculture has been stationed with the College of Agriculture, so far as I know there has been the most cordial co-operation, the most friendly relation and absolutely no friction between the two bodies; and when the Board of Agriculture sets out upon a certain campaign of education, which might in some ways be considered the function of the College of Agriculture, it has always been with the fullest and fairest understanding, and with the most cordial consent.

And then again, when the College of Agriculture should at any time begin the work of exploitation, or the extension and carrying on the research of some line for the improvement of agriculture, which might by some be considered a part of the work of the Board of Agriculture, it has always been likewise with the common consent of the other party. And so these two institutions stand here to co-operate, to support and to assist each other.

The College of Agriculture, with its Experiment Station, develops and discovers the facts, and the Board of Agriculture, with its machinery, and with its hold upon the people, reaching down to the farmers, is carrying this discovery, with its results and application, to the people of the State. Thus there is no duplication, there is no friction, there is no lost motion in this arrangement; but it is an arrangement which permits the College of Agriculture to occupy one field, primarily discovering the truth in reference to practice on the one hand and on the other teaching it to the students who come here; and the Board of Agriculture to occupy another, that of carrying this information to the farmers direct.

It is peculiarly appropriate in my judgment that the Board of Agriculture should come here once each year and hold a convention like this. It is also peculiarly appropriate that the farmers should get together once a year, at least. Standing isolated, as they are, they forget, if they ever fully realize, their own importance and the importance of their profession. Getting together in this way, they begin to feel more proud of themselves and of their profession.

When I see any assemblage of farmers, I always think of the old fable that all of you have read or heard many times, of the peasant who thought he was going to die, and called his two sons to his bedside and said, "I am about to die, and I am going to leave to you the little plot of ground behind the house, the vineyard. In that vineyard is buried a great treasure. All you need do is to dig for it, and you may find it." And he passed away, and the young men, strong of arm, set about to find the treasure, the pot of gold, and they dug the vineyard over most carefully and failed to find it, and thinking perhaps they had not gone deep enough, they dug again still deeper, and failing again, went still deeper, with the same result, and when they came to the conclusion that their father was beside himself at the time he had said these words, and that there was no pot of gold, no treasure buried there, and they went their way. But they came back the next summer, and lo and behold! There was a crop of fruit on their vines such as they had never seen before, and they harvested it, and from that came their pot of gold. It was the treasure that had been buried in that soil, and that was what their father had referred to. And so it is with agriculture.

Yet, when we begin to think of the mineral wealth of our country, when we begin to survey our wealth, we begin to figure immediately the gold, the iron, the lead, the silver and that class of minerals which have been styled "the precious metals." The truth is, however, that last year's crop mined out of the soil by the farmers of the United States amounted to more than six billion dollars, and was worth more than all the gold and silver mined in America since Columbus discovered it. The truth is that the greatest mineral resources of this country is the mineral plant food within its soil. The greatest mines are our farms, the greatest miners are the farmers themselves. It is the only mining business that is permanent; it is the only business that is basic. Our silver mines work out and the cities based upon them pass away from the earth; but the cities, the universities, the churches built upon agriculture, stand; they are permanent; they are as everlasting as the hills themselves, provided the farmer who mines that soil mines it intelligently, appreciates its own limitations, and does not waste its resources. (Applause.)

As illustrative of this very basic industry, let me cite another illustration. Just a few days ago I happened to be in conference with a gentleman who represents great millions of accumulated wealth of the eastern portion of the country, which had been placed in his hands for the development of education. Rockefeller had placed at his disposal twenty-five million dollars; others additional sums. He said he had gone into other portions of this country, not Missouri, with a view of strengthening the universities, and with a view of strengthening and upbuilding certain departments of that State, and the schools of which State were not well supported until they began to support them. He said they investigated the condition of the university and found it was not the university which was at fault, and concluded that the fault must be with the preparatory or high schools, and they therefore made an investigation of them, as they knew it was necessary to properly build them up before they could support their university as they should. But it was found that the difficulty was not in the high schools; that it must be more basic than that, and the conclusion was that it was with the primary schools, and that they must therefore look to these and the strengthening of them if they would hope to build a high school system, and rest a university upon it. And when they investigated the primary schools they found the fault was not there, but that they rested upon an agriculture that was not prosperous, and therefore strong schools could not be made. They were thoroughly convinced the difficulty in the school system was with the agriculture, and they set about to spend their money strengthening the agriculture of the section which they had first sought to expend toward the strengthening of the university, after they had finally seen that, when their agriculture was strengthened, the district schools and high schools and university would be supported and would take care of themselves. That is a natural and logical conclusion anywhere you go; and anywhere the agricultural industry is basic, if that is false, if that is weak; if behind it is a man without nerve, without strength and without mental capacity, the whole superstructure of whatever kind is of the same sort.

Fortunately, the Missouri farmer is an intelligent farmer, is on good land, is prosperous; and when those conditions prevail everything else prospers with them. And it is only when the leading farmers come together like you gentlemen, in this way, and compare their experiences and get the best thought and the results of the best study and investigation, that we will continue to have on the Missouri farm the best intelligence of the State, the most progressive men in the country and the most prosperous of all classes of people. (Applause.)

Missouri State Dairy Association.

Condensed report of the proceedings of the 17th annual convention, held at Columbia, January 10-11, 1907.

STATEMENT.

The seventeenth annual meeting of the Missouri Dairy Association was held at Columbia, January 10-11, 1907, in conjunction with the Improved Live Stock Breeders' Association and the Missouri Corn Growers' Association.

By joining with these other two State Associations, better rates were secured on the railroads, and a stronger program presented. Mention is made below of persons who contributed to the success of the program, but whose addresses are not included in this report:

Invocation by Rev. C. H. Winders.

Address of Welcome by Hon. W. S. St. Clair.

Response for Dairy Association, Secretary R. M. Washburn.

"What Have We a Right to Demand of Our Cows?" Prof. Oscar Erf, Manhattan, Kas.

"Dairy Farm Crops," Hon. C. D. Lyon, Georgetown, Ohio.

"Does it Really Pay to Weed Out Poor Cows?" Hon. H. B. Gurler, DeKalb, Ill.

"The Future Dairyman," Hon. W. W. Marple, Chicago, Ill.

Debate (by agricultural students)—Question: "Resolved, That more profit may be derived from the special purpose dairy cow than from the dual purpose cow."

Affirmative—B. O. Brown and R. A. McCoy.

Negative—H. P. Rusk and H. H. Krusekopf.

"Eastern vs. Western Opportunities for Dairy Farmers," B. D. White, Washington, D. C.

PRESIDENT'S OPENING ADDRESS.

(Geo. O. Mosher, Kansas City, Mo.)

Gentlemen of the Missouri State Dairy Association:

The seventeenth annual meeting of our organization finds us in the most gratifying environment as compared with the past.

We are beginning a new era, this being the first meeting under auspices which ally us with the other great agricultural and breeders' associations of the State, and thus draw more attention to the dairy industry in the position it must occupy in our State, as land gradually becomes higher priced and farms cut up into smaller tracts. The experience of Missouri in the raising of cattle has been always along beef lines. As one gentleman recently expressed it, every effort was made to get fat on the animal. Any cow that could have a calf was considered good enough to give milk. A good illustration of this is given in Professor Fraser's object lesson, where he shows 19 good dairy cows worth 1,900 of the kind which give only enough milk to pay for their feed; or, as has been shown in Hoard's Dairyman cow census, many of these cows were fed at an actual loss to the owner, not counting the value of his time in care of his herd nor the investment in the cows. A most lamentable picture.

I believe one of the greatest boons to the farmer is the Experiment Station and the institute work under its direction. We have the men in Missouri who are doing this great work of building up our agricultural wealth until she is an empire beyond question. Take the matter of corn breeding and selection. If followed out intelligently, it is not such a burdensome task; yet if each farmer will adopt this system, it will add millions to our annual corn crop. The same statement applies to the work Mr. Ellis and Dean Waters are doing along the lines of stock breeding, and our own Professor Eckles, in the dairy division, is undoubtedly adding to the worth of our herds of dairy cows by advice in breeding and feeding which is hard to appreciate, unless one follows the history of the work which has to be done.

The intelligent and painstaking care which Dr. Luckey, our State Veterinarian, has exercised, will minimize, and finally, practically eliminate tuberculosis from Missouri herds.

The good roads propaganda is a child of the Experiment Station, and bids fair to have a vigorous and valuable development.

It is a pardonable pride that points to these great movements in Missouri.

We have been working for years as a separate entity. Now we come in close touch with the other great lines of modern farming industry, and the result must be an increased impetus to all branches of agriculture.

It is not out of place at this juncture to express our appreciation of the great good fortune we have in the eminent gentlemen who have given their time, and who will devote their valuable thought to our advancement in the program to be enjoyed at this meeting.

The dairy division of the National Department of Agriculture has been most generous, and year after year, sends of its best to our meetings—this year Professor White, one of the practical scientists of the dairy world. Not the least entitled to our thanks is the great dairy and agricultural press, which sends the lectures and teachings of all the best minds to every corner of the State. No dairyman can hope to succeed unless he takes and reads these most valuable newspapers. They are the encyclopedia of knowledge of dairying.

The dairy industry in Missouri is fast assuming the importance to which it is entitled. This statement has reference to the various points where improvement has been wanting; a larger investment in dairy equipment; better dairy cattle; higher type of finished product; and to the farmer, a better price for his goods.

Why should Missouri be paying out $2,000,000 surplus to other states for her milk, butter and cheese? There is no better pasture in the world than our blue grass, and in the center of the corn belt we have ensilage produced at the minimum cost per ton.

The making of ensilage in Missouri is a new method of feed supply. Naturally it is looked on with some degree of question until its value is more thoroughly established. Who would need an argument if he were to realize that the chopped corn stalk has more feeding value than any roughage except alfalfa, and it is to be had at a cost of $1.25 to $2.00 per ton in the silo. This year in particular, when hay is selling at $10 to $16 per ton, it takes very little arithmetic to settle in the minds of the average man, what is profitable feed.

The price of mill feeds is less by one-third than the dairymen in New England pay. We have the market within our own borders. "Every prospect pleases." There remains to be accomplished only the education of our people to realize how valuable an heritage is being wasted in the overlooking of these great opportunities. On the high-priced land in Holland the dairy farmer has made fortunes which are proverbial. No doubt the same condition prevails in the channel islands. We have thousands of acres of rich pasture land, which could be brought to return big yields of profit if put to use in raising dairy stock.

The advent of the great creamery concerns, with their agents ready to take cream at the door and return a monthly check to the farmer, reduces his otherwise financial business outlook to a system, which gives him ready cash to meet his obligations, and a margin to add to that received from the sale of surplus farm products at the end of the year.

In the vicinity of the great cities of the State the opportunity to participate in the higher-priced market for commercial milk and sweet cream, should make every small farmer essentially a farmer, and only incidentally a general farmer. In other words, his success will lie in his being able to feed his crops and turn them into milk and butter; the by-products, the skim milk being converted into pork and veal, rather than to strip the farm each fall of its earned reward. The economic saving of the fertilizer contained in the manure of a herd of dairy cows will in many cases decide the chances between failure and success in farm operations.

These statements, it is realized, are not new. They are none the less valuable because of this, because the truth is always mighty and never loses interest in being kept before us.

We have many reforms to work out aside from the problems of balanced ration and season for breeding cows, the advantages of clean barns, clean cows and pure water supply.

We would look to the State Legislature for help in many lines. We want changes in the dairy laws; in the laws with reference to the sale of artificial substitutes for dairy products; for the prevention of adulteration of our output after it leaves the farm in a pure state.

We want a fair and reasonable standard for fat and solids in milk. The Pure Food Laws will harm no honest producer. It has raised the retail price of commercial milk in Kansas City to eight cents. The farmer should have his equitable share of this increased price for his wares.

The subject of sanitary milk has received, through the press of Missouri, more attention than it ever before could boast. Keep up the agitation until every consumer is educated to demand better milk, but to realize that for a high class article he must pay an increased price commensurate with the increased expense of production.

In closing, may I express my profound thanks to the Association for conferring on me the undeserved honor of being its President during the year just closing.

I look forward to the new administration, taking up the work with industry and enthusiasm, which will show 1907 the grandest year in our history. I am sure the present meeting will be one of much value, and an inspiration to every member to do his share to make Missouri the greatest dairy State.

Gentlemen, the meeting is open and ready for consideration of business.

THE INEVITABILITY OF DAIRYING.

(H. J. Waters, Dean of Missouri Agricultural College.)

The subject, "The Inevitability of Dairying," is not of my own choosing. I am not by birth, education or sympathy a dairyman. My sympathies and tastes are all in the other direction—the production of meat, and primarily the production of beef. I like the Shorthorn, the Hereford, or the Angus much better than I do the Jersey or Holstein or Guernsey, and I like the beef business much better than I do the dairy industry. Nevertheless, I realize that the man who stands out against dairying as the basis of our permanent agriculture is standing out against an irresistible force, and will in the end be as effectual as he who with a broom attempts to sweep back the ocean tide. Either this country is going to be an exception to all human experience, or we must ultimately surrender to the inevitable.

There is no question that as population becomes denser, as land becomes higher, as labor becomes more abundant, and, therefore, cheaper, we must produce on our farms products which will require and reimburse more labor.

The beef business is primarily adapted to the newer conditions of a country, to broad acres, to cheap land, to scarce and high-priced labor, to transportation of products over long distances. As the country becomes more densely populated and land becomes higher, they look to something else. New York, Pennsylvania, Massachusetts, New Hampshire and Connecticut were formerly the great beef producing centers of this country. Then the dairy industry was being nursed and carried along by its enthusiastic friends as perhaps it now is in Missouri, and the beef business was able to take care of itself, as it yet is with us. Now the dairy business dominates in the east and they are trying to coax back the vanished beef industry.

Thus, as the country becomes older, its land divided into smaller farms, and the people get on a more economical basis and conservative basis in both production and consumption, the beef industry is the first to wane. In its stead, as a rule, comes dairying. First, in combination with beef, it is true, but later, especially in the vicinity of the large cities and among the most congested centers, it becomes a highly specialized industry. In the rural districts this combination of beef and dairying has thus far remained stable in the oldest European countries, with dairying as the principal feature and beef as an adjunct.

Broadly speaking, the next class of beef products to diminish, outside of the mountain and the strictly grazing regions, is the sheep. Then follows the hog, although on account of the use to which the hog may be put as a consumer of waste products around the household, he remains to this day a prominent feature in the agriculture of the most densely populated regions of the country.

As countries become still more populous, vegetable diets supplant practically all forms of animal products, the one standing out to the last being poultry.

While it is true that the fowl, when charged up with all the feed consumed, produces the most costly animal products known, at the same time it lives so largely off the products that would otherwise go to waste, is so well adapted to living in close proximity with people themselves, that it is perhaps the most permanent animal industry that we have. It is an interesting fact that this is the only animal industry that China has left. She has long since ceased to produce beef, if she was ever a beef producing country. The dairy cow has been driven out, if this industry was ever established there. But the duck and the goose and the chicken are still there in such quantities that this constitutes one of China's most important export products. Even as well adapted as the State of California is to the production of poultry, San Francisco buys eggs from China by the hundreds of thousands each year. The fowls themselves are exported in large quantities to this country. It is likewise interesting that much of the albumen used in sensitizing of photographic plates comes from China, and is made from the egg.

BEEF COSTLY TO MAKE AND SELLS AT A LOW PRICE.

There is another and perhaps a more fundamental reason why the beef industry is the first to go. This reason, however, has not as a rule been made clear in our discussions of this subject.

The cost of producing a pound of meat from the three principal sources would be about in this order: First, beef; second, perhaps, mutton; third, pork. In other words, pork costs less to produce than either of the others, although the difference between it and mutton is not large, and on the average is much less than the difference between either of these and beef.

On the other hand, however, these animals bring on the market, when fitted as they usually are, taking the experience of the last twenty-five years as a basis, prices in just the reverse order. That is, hogs have perhaps sold highest, with sheep a very close second, and cattle considerably below either.

It is evident, therefore, that in a strictly agricultural region, such as the Mississippi Valley, the margin between the cost and selling price has been lowest in beef of any of our meat animals.

It is a striking fact that during the last twelve months there was not a sheep sold at the St. Louis market for less than $5.00 per hundred, while thousands and thousands, in fact, the majority of the cattle sold on that market, brought less than $5.00 per hundred.

We have not yet, however, approached the most cogent reason for the elimination of the beef industry when great economy must be exercised in production and consumption.

THE EFFICIENCY OF THE BEEF STEER AND THE DAIRY COW AS A PRODUCER OF HUMAN FOOD COMPARED.

The most striking fact in connection with this whole question is the inefficiency for the production of human food of the beef animal as compared with the dairy cow.

Let us assume that we full feed a steer for 300 days, and that his average daily gain for that time is 2¼ pounds, making a total gain of 675 pounds. In the same length of time a dairy cow of quality equal to that of the steer above assumed would produce, at the very least, 6,000 pounds of milk. The dairy cow will require for the production of her annual milk output less grain, less hay, less grass and less range than will the steer in the production of its 675 pounds of gain in weight.

Let us, however, inspect these total annual products more closely.

Assuming that the 675 pounds gained by the steer will have the composition shown by Jordan in his studies of the composition of the gain made on animals from 17 to 27 months of age, *we should have the following detailed exhibit:

	Per cent.	Pounds.
Water	42.4	286
Fat	37.5	253
Protein	14.1	95.5
Ash	6.0	40.5
Total dry matter		386

The 6,000 pounds of milk produced by the cow in the same length of time might be safely estimated on the basis of:

	Per cent.	Pounds.
Water	86	5160
Butter fat	4.6	276
Milk sugar	4.75	285
Casein and albumen	3.85	231
Ash	.8	48
Total dry matter		840

The water in the meat and in the milk is of no more value for food than that which comes from the cistern or spring, and we are, therefore, primarily interested in the quantity of dry matter produced.

It will be observed that the cow's annual output of dry matter is 840 pounds, as compared with 386 pounds for the steer.

A close scrutiny of the detailed figures given above will show that the whole story is not yet told. The steer's product will need to be still further reduced, because a portion of the gain made is inedible, being in the form of increase in weight of bone, hoof, horn, hide, vital organs, blood, etc. We have no reliable data from which to estimate the amount of the annual growth of this material on a steer, but it is certainly safe to assume that the six per cent of ash shown by Jordan's figures in the above table would not be an over-estimate of the amount that would be classed as

---

*Jordan: "The Feeding of Animals." Page 340.

inedible and of use only for the manufacture of leather or fertilizers. On this basis there would need to be deducted 41 pounds from the total of 386 pounds of dry matter, leaving a total of 345 pounds of edible material produced by the steer, compared with 840 pounds produced by the cow.

There is yet a difference to be considered:

The fat produced by the cow is the most digestible of all the animal fats. The sugar in milk is perhaps the most easily digested and assimilated of all sugars, and is assumed to be all available when used as food. In the case of casein and albumen, it is practically completely digestible, and the same is true of the ash. Therefore, not only is the edible material produced by the cow more than two and a half times as large in amount as that of the steer, but it is a significant fact that practically all of this is digestible and easily assimilated by people of all years, from youth to old age.

In the case, however, of the production of the steer, there is a further waste. For when the animal is slaughtered the butcher is compelled to trim the carcass of its excess fat or tallow. In the average case this green tallow is not worth as much per pound as he has paid for the steer alive. This tallow has perhaps cost the feeder ten cents or twelve cents a pound to make, and it has a value when sold as such, and not attached to a steak or roast, of perhaps less than four cents. Furthermore, when the butcher divides this carcass into steaks and roasts, the customer is constantly insisting upon having the excess tallow trimmed off before it is weighed. All of this tallow must, like that which was trimmed from the carcass when the animal was killed, go into the tub as low-priced material. Furthermore, when the steak or roast is cooked, a considerable portion of the fat is fried or stewed out, and this is likely to be poured into the garbage can or the sewer. Then, when the meat comes to the table, the first protest from the children is against being given too much fat. The portion of the steak or roast that is left uneaten is the fat, and this is essentially wasted or fed to the dog, the chickens or the pigs.

Thus, this high grade material—that is, material that is most expensive of all animal products to make, is really of least practical use for human consumption, because it, unlike butterfat, is of itself not especially palatable.

In New York City so much fat is poured into the sewers that recently the city authorities set about to recover it, and millions of pounds are thus taken from the sewerage and sold at a low price, chiefly for the manufacture of soap. This means that the corn of the Mississippi Valley is being converted into high-priced fat on our hogs, cattle and sheep, a portion of which finally finds its way into a soap factory through the sewers of our great cities.

Just what number of pounds of the annual production of the steer would be actually left as digestible material it is impossible to say, but it is perhaps not unreasonable to say that the amount of digestible matter produced by the cow is about three times as large as that produced by the steer in the same length of time.

Thus it is perfectly evident that the dairy cow is a very much more efficient machine for the manufacture of our grain, grass and hay into edible animal products than is the beef steer, or than is any animal producing meat, for that matter.

Of equal importance is the fact that the cow will make the yearly product ascribed to her in the foregoing computations on grass alone without grain during the summer months. The rest of the year she will eat less grain per day than the steer will require. On the other hand, it will be necessary to feed the steer to the full limit of his appetite for each one of the 300 days figured in the foregoing tables in order to have him make the amount of gain credited to him. All these figures for the cow are in every way conservative. It is likely indeed that the amount of food consumed by the steer to make the gains used in our computations would produce fully one-third more milk and total solids than has been credited to the cow.

RELATIVE COST OF BEEF AND DAIRY PRODUCTS.

Because dairy products have uniformly sold at a very much higher price than most other animal products, it has been assumed that the cost was proportionately greater. Professor C. H. Eckles, of the Department of Dairy Husbandry of the University, has been kind enough to supply the records of two cows in the University dairy herd of fair to good quality, as follows:

Cow 1.		
Milk produced in a year	6988	pounds.
Butter produced in a year	424	"
Milk solids produced in a year	992	"
Cost of feed for 12 months	$30.00	
Cost of butter per pound	7	cents.
Cost of milk solids per pound	3	"

Cow 2.	
Milk produced in a year	6910 pounds.
Butter produced in a year	366 "
Milk solids produced in a year	918 "
Cost of feed for a year	$34.60
Average cost of butter per pound	.094 cents.
Average cost of solids per pound	.034 "

The feeds used in the six months winter period were: Corn chop, at 40 cents per bushel; clover hay, $8.00 per ton; corn silage, $2.50 per ton.

During the six months summer period the cows were at pasture, received no grain, and were rated at $2.25 per head per month.

These were not specially selected cows, but happen to be fairly representative animals of which Professor Eckles had a complete record.

It will be observed that the cost of feed per pound of butter varied between seven cents and nine cents. This is not much in excess of the cost of gain on aged steers made thick fat or that are fed six months or more. The cost of gain on cattle of this sort could be safely figured at the minimum price shown here for butter, namely, seven cents. The low price for total solids of from 3 cents to 3.8 cents per pound is in striking contrast. We would need to about double this price for the gain of each pound in live weight of a steer. When it is further realized that fully one-third of this gain in live weight of a steer is water, and that still another portion is inedible, and still another portion is indigestible, and that these total solids produced by the dairy cow are free from water and are all edible and practically all digestible, one cannot fail to be impressed with the efficiency of the dairy cow in contrast with a meat producing animal like the steer.

FINANCIAL RETURNS FROM THE DAIRY COW MUCH LARGER THAN FROM THE STEER.

The record of the University dairy herd of 34 cows, including all 2-year old heifers for last year, showed an average of 6,792 pounds of milk and 369 pounds of butter each. The average local retail price for the year for butter was 28 cents per pound. At this price the financial return per cow, without counting the calf, was:

369 pounds butter, at 28 cents per pound	$103 32
5,773 pounds skim milk, at 25 cents per hundredweight	14 43
Total return per cow	$117 75

CREAMERY VALUE.

At the butter fat prices paid by the Dairy Department of the University for cream bought from patrons in different parts of the State this would amount to:

316 pounds butter fat, at 26 cents per pound	$82 16
5,773 pounds skim milk, at 25 cents per hundredweight	14 43
Total return per cow	$96 59

From a few of the leading dairymen of the State Professor Eckles gives me these data:

S. H. Pile, Glasgow, Missouri, reports a gross income of $120.00 per cow for 17 head.

E. & E. J. Hosmer, Marshfield, Missouri, have 71 cows, which averaged over 340 pounds of butter, selling at 23 cents per pound, or $78.20 per head for butter alone.

Squire Innis, Nevada, Missouri, sold products to the value of $119.50 per head for 22 head.

E. B. Cooper, Trenton, Missouri, reports a return of $2,050.00 from 25 cows.

S. W. Coleman, Sedalia, milks seven cows that average 400 pounds of butter each. This is sold at 25 cents, and the skim milk is fed to calves and pigs. He sold $850.00 worth of hogs and $700.00 worth of butter in a year. All from 10 acres of land.

H. C. Goodrich, Calhoun, Missouri, sold 331 pounds of butter per cow for 32 head, at 23.8 cents per pound.

Geo. Koontz, Carthage, Missouri, realized $3,161.00 from 31 head of cows for butter at 25 cents and 30 cents per pound, or an income of about $102.00 per head for butter alone.

DAIRYING THRIVES IN HARD TIMES; THE BEEF BUSINESS IN PROSPEROUS TIMES.

Another way to illustrate the superiority of the dairy cow, or to emphasize the profits of the dairy business, is to consider the fact that when prices are low and times are hard, men leave other specialties in farming and engage in the dairy business. Upon the return, however, of good times, with high prices and good opportunities for fair remuneration in all lines, dairying is neglected, because men can make more money comfortably in some other way.

DAIRYING ADAPTED TO GOOD LAND.

It is a popular notion that land too poor or too rough to yield profitable returns in other lines of agriculture is well adapted to dairying. While it is true that dairying will thrive on land on which most other forms of agriculture will fail, for the very reasons already pointed out, it is a fundamental mistake, however, to assume that because of this fact dairying is adapted only to regions of that sort. The truth is, dairying is just as well adapted to the best land of the country as it is to the poorest, and the dairyman ought to insist upon taking possession of the best of this land, where are already developed the best schools and churches, where he has the best roads, the best markets, and all the modern conveniences.

The beef men cling tenaciously to these best regions, and will not surrender their business or their places easily. They are not built along that line. When they have not the dairyman to fight, they fight among themselves. But one thing is certain; that the average beef man must mend his ways or yield to the inevitable.

THE BEEF MAN MUST IMPROVE THE QUALITY OF HIS STOCK.

We are interested in extending as much as possible the consumption of animal products, particularly of beef, because the race that will dominate the world with its ideas, its form of government, its religions, its point of view, its language, its culture and its general point of view will be the race of people that eats meat. The role of beefsteak in the world's civilization has been of tremendous importance.

Last winter one of the graduate students in animal husbandry in the University collected statistics from a large number of cattle men in the corn belt, principally in Missouri, Iowa and Illinois. It was shown by the returns from these men that the average calf was worth at weaning time $15.00. For the production and nourishment of this calf a cow was kept the entire twelve months. It has already been shown that the gross return from good dairy cows, without counting anything for the calf, varied from $75.00 to $120.00. It is perfectly feasible, without materially increasing the expense, to produce calves that are worth at weaning time for beef purposes from $25.00 to $35.00 per head.

It will be necessary, therefore, for the beef men, on the high-priced land of Missouri, Illinois and Iowa, to either produce this class of beef and feed it out as baby beef, or leave the raising of the cattle to the owner of cheap grazing lands in the west. This will mean, then, that they must become cattle feeders rather than cattle raisers and feeders if they wish to continue in the beef business. Or, if this be not satisfactory, to choose between the suicidal policy of selling the grain or engaging in the dairy business.

THE COMING OF THE MILKING MACHINE MARKS AN EPOCH.

In the past the chief trouble in the dairy business was the difficulty in securing labor of the proper sort the year round, 365 days in the year, to do the milking. If the milking machines are the success that they seem to be, so that the work may be done by machinery, and this labor problem thereby eliminated, the Missourian is going into dairying.

WHAT WE MAKE OUT OF OUR COWS, AND HOW WE DO IT.

(S. H. Redmon, Tipton, Mo.)

Gentlemen of the Missouri Dairy Association: You will no doubt realize my embarassment coming before this learned body, with its Gurlers and Erfs, its Lillys and Whites, its Eckles and Washburns, and many other of state and national reputation, to discuss with you the above subject. And yet believing, as I do, that grand old Missouri, with its natural and varied industries and resources, can be made one of the best dairy states in the Union, I feel that as one of her sons I would be untrue to the State of my birth did I not try to comply with the request of our Secretary to say a word in its behalf.

Redhurst Dairy—We, at Redhurst dairy farm, have, during the past year, the twelve months ending December 31, 1906, milked on an average of fifty cows, ten of which were cows with first calves, and sold butter fat to the amount of $3,231.95, or an average of $269.33 per month, besides three gallons whole milk per day for home consumption, and the whole milk fed to calves until they are six weeks old.

We raise all calves except grade Jersey bulls, which are vealed.

As to how this is done: We have a barn with double wall, the outside wall being lined with building paper inside and thoroughly ventilated according to King system. Each cow has a good, airy, light and comfortable stall. We try to keep cow clean, barn clean and hands clean; milk into Gurler buckets, take direct to cream house, which is detached from the barn, separate it and bring it down to 40 degrees.

Feed Silage—Our cows are fed from the farm, excepting bran. We give them, from October 15 to June 15, 40 pounds green corn ensilage, corn and cob meal, all the shredded fodder they will eat, and bran, and keep up the grain while cows are on the grass, but not in so great an amount.

All the heifer calves which have good mothers are kept for future cows. All the bulls from thoroughbred high-class cows are sold for breeding purposes. The skim milk is fed to these youngsters until they are six months old. The balance is fed to hogs. The best way, I believe, is to give to the sow until pigs get large enough to drink, after which give to pigs and add cornmeal, making a mush. In this way, we think, with very little corn, we are enabled to bring the pigs to 150 to 160, when they can be turned off.

Then, again, there is the manure of the herd. We get about one spreader load of manure per day from our cow barn. Then the horse barn, calf and pig pens furnish almost, if not quite, another load a day, or 700 loads per year, valued at $1.00 per load, which I think very reasonable, would make $700.00 per year.

Expenses—Now, as to the expense of running such a place. We pay hands about $100.00 per month, except during siloing and harvesting, both of which is short. We buy bran, but sell wheat, the only grain we sell from the farm. We have the natural increase of 40 to 50 calves per year, as well as four to six colts and young horses and mules. We have the sale of 140 to 160 head of hogs each year, and all the time we are enriching our farms.

So, taking everything into consideration, I think the one who would not be satisfied with this kind of showing would be hard to please.

Start right—Now, a word of advice to those thinking of entering this field would be, begin on rather a small scale, try *only* milk cows, and when you get one that is not a milk cow, sell her, no matter how pretty, how well bred, nor what she ought to do, the fact is more money is lost in keeping the ones which are boarders than any other way in the dairy business.

WHAT I HAVE LEARNED FROM 3,000 YEARS OF PERSONAL EXPERIENCE WITH A COW (30 YEARS WITH 100 COWS.)

(By Hon. H. B. Gurler, De Kalb, Ill.)

Mr. Chairman, Ladies' and Gentlemen: I am glad to be with you again. I was talking yesterday but had to saw right off in order to make room for somebody else. I think we ought all to feel mighty good this morning after feeding on that red roan steer last night, and the dairymen ought to get a lot of satisfaction out of it, if it is true, as I am told, that they actually fed that steer on the milk of a Jersey cow. Now if a shorthorn steer is allowed to nurse on a Jersey cow, and if you cannot get fine beef that way, I don't know how to get it.

I never had any finer beef, and I awoke this morning feeling mighty good. I got a good night's sleep last night, and I feel like working this morning. At home, lots of my friends say it is so long since they have seen me work, that they have forgotten that I ever did, when the fact is, I was once one of the hardest workers on the farm.

Babcock test—I gave yesterday a brief account of my early experience at testing cows. We had no Babcock test then. We used first a percentage glass and found the percentage of cream, and then we churned the cream from the milk, and I followed that up with my dairy, having some forty cows and having it all to do myself, and brought the thing up to the time the Babcock test came into use, and that simplified matters tremenduously. It cut the labor twenty times in two and was fully as accurate as the old way. I had worked many years trying to build up my herd, and I was always finding out something new.

Abortion—I remember how surprised I was down in Pennsylvania when I heard Dr. Pearson describe contagious abortion. It was a revelation to me. I remember how I doubted it. I was so skeptical I said to Dr. Pearson, "Do you believe that is so," right on top of his lecture. But I was convinced, and went home and on the strength of what he had said, the next time contagious abortion started in my dairy herd, I knew just what to do. The first cow that aborted, I isolated her, and every cow that aborted from that time on, went to the stable over across the road, away from the herd, and then I cleaned everything up where she had been.

Out of the first experience with sixty cows, there were thirty-five abortions, and it just ruined that dairy. After I learned that it was a contagious form, and that was what was doing the mischief, I went after it and headed it off before it could hurt me materially.

Later I had a larger dairy and when the sickness attacked it, had eighty cows and twenty-one aborted before I cut it off. Now, as soon as a cow aborts, we do not wait to find out whether it is accidental or anything like that, but we isolate her right away and clean everything up.

Q. (Audience) Do you sell that cow?

A. If it is a good cow, I keep her, because I don't know that she is any more likely to abort again than if she had not done so. I have in my dairy now a splendid young Holstein cow that has aborted two years in succession, but she is a fine cow, and I am going to try her again. Perhaps it would be good for us to have Dr. Luckey give us some of his ideas on this subject. I see him back there, come up and give us your ideas, as to the disease and its treatment, especially its treatment, Doctor Luckey.

Doctor Luckey: The treatment of contagious abortion is one quite inexpensive and simple in its application, and which, if carried out, is almost sure to prove absolutely successful. The dairyman in charge of the Southern Hotel Dairy at St. Louis, had something like one hundred cows, and they all became affected with this trouble, but the year I was there they went through the year with the loss of one calf.

The treatment consists first in washing the regenerative organs, and the rear parts, and of internal administration, of a solution of carbolic acid. As a wash I would suggest that you use pomanganate of potash, one ounce to eight gallons of water. It is not expensive, is very effective and is probably the best of all washes for this purpose. I will not stop to describe the fountain syringe for internal administration, and all that, which you can devise for yourselves. But I will say, if you want to handle the herd properly, build a place to handle them, by building a chute where you can handle them one at a time.

I do not favor feeding carbolic acid, for you may have to starve your cows in order to make them eat it, and this will cut down their milk. You can get better results with carbolic acid by using a two per cent solution. That is equal to carbolic acid two parts and water ninety-eight parts. Use pure crystal carbolic acid in this proportion, because if you use a weaker solution you will not get the strength. With a hypodermic syringe (and the ordinary black leg syringe will answer this purpose) inject every ten days of this solution thirty-five to fifty cubic centimeters or nine to twelve teaspoonfuls. Most syringes have the cubic centimeters marked on the syringe handle. A cubic centimeter, for all practical purposes, means fifteen drops. Four cubic centimeters make a teaspoonful. Run the needle through the skin anywhere on the animal's body. It is most convenient on the shoulder where the skin is easily pulled up and thinner, and while you run the needle through the cow's skin, if you will have some one take hold of the nose and jerk the nose rather violently the moment the needle passes through the skin, she will not know it goes in and you will not have any trouble from that source. The nine to twelve cubic centimeters is a rather large amount to put in one spot, and it will be absorbed better if distributed in smaller quantities. This injection should be made in the cows of the herd that have not aborted as well as those that have, because we don't know which ones are likely to become inoculated and abort.

But I want to make this plain. In giving carbolic acid, be governed by the action on the individual. You want to give full doses. How can you tell how much you can give? If you will watch the cows closely, you will see when they have a full dose that the pupil of the eye is somewhat enlarged. That indicates you have given enough. If you do not get that result in the animal, the next time you administer the carbolic acid you had best do that. If you get too big a dose, you will cause temporary paralysis and the cow will lie twenty-four hours, probably, without being able to move, though without any material injury to the cow.

I think this fairly well covers the case, and I think it unnecessary to go into further detail right now. I might add that this treatment should be continued every ten days through the period of pregnancy.

Mr. Gurler (continuing): We will go back thirty or thirty-five years when this trouble was so serious in New York State that the legislature appropriated ten thousand dollars for the purpose of stopping it. I remember Mr. Harris Lewis, one of the commissioners who helped to spend the ten thousand dollars appropriated, said when they were through, "We don't know so much about the cause of abortion as we thought we did when we commenced."

Cows put on their merits—There was a period of time after I left my farm that I dropped the testing of the cows individually, because I could not be there to try the churn test, and then the Babcock test came along and we began using that. I always believed in setting a butter standard for my herd. In 1892 I made my standard 198 pounds. I had to sell twenty-one of the cows that I was using at that time. In 1894 I raised the standard to two hundred and twenty-five pounds, and I had only six cows to sell.

In 1895 I commenced to get ready for the certified milk business. I was in the business for ten or eleven years, and then, with the risk that there was, I had to buy cows to increase my dairy to keep pace with the demand, and there was quite a risk on account of tuberculosis. We had to test the animals and I dropped my standard back to two hundred pounds on account of that risk. All I could do was to buy the cow and take her on my own risk, and whatever I had to slaughter were my own loss for several years. I put this dead line at two hundred pounds of butter or 172 pounds of butter fat, because when they dropped below that, there was no money for me in it. After I had paid for the feed and labor, if they could not make this, I had simply nothing left. If I had to depend upon that dairy I might as well have quit the dairy business and gone out to work for twenty-five dollars a month as to keep cows that would not come up to that.

In the year 1900 I shipped milk to the Paris Exposition. Your secretary was practically right about what he said in regard to that. The milk was seventeen days on the road and kept sweet four days after it reached Paris, France. That milk was a revelation to the French people, and they could not believe it had not been doctored until they gave it a test. Major Alvord, at the head of that dairy commission, told me the milk produced near by was not fit for use after two days, and in hot weather was not fit for use after twenty-four hours. Yet milk shipped from the United States kept for twenty-one days.

In the year 1900 I have the figures on a stable of my cows. The best cow in the stable made 472 pounds of butter and a profit of $50.74. The poorest made 174 pounds of butter and lost me $11.00. Now, what is the sense of an intelligent man going blundering along through life and not understanding their own cows as individuals? The best cow, it costs me to feed, $46.06, the poorest cow $31.23. Some people have an idea that it costs no more to feed one cow than another, but that is a mistake. Because some cows have not the capacity to handle the feed that others have; and one cannot buy that capacity; it is bred in them.

I remember a little incident in my own town. I knew the parties well. There was a young lady in school who could not get along; she could not keep up with her classes. Her mother complained, and the teacher said, "Your daughter has not the capacity," and the mother said, "I will have her father go right down town and buy it." The same is true with regard to cows.

Now this stable of cows, where there were fifty cows in 1900, made an average of 298 pounds of butter. There is nothing impossible about that. You have dairies here in Missouri that do that. I am told that there is a German in your state who gets his butter average up to four hundred pounds. You do not need to go into Illinois, Iowa, Kansas or anywhere else for examples of this. You have them right here. I would like to emphasize this point and put it up before you in a way that you will see it. If a man has fifty cows that will make four hundred pounds of butter in a year, he can sit down and hire all the work done, merely supervising it himself, and he can have an income of two thousand dollars a year and be a gentleman. Where is the average college professor in comparison with that? Of course, somebody like Dean Waters here will do better than that, but where is the average professor beside it. Especially do I want to impress this upon these young men who are getting their education here. Just stop and think about this, and if you do not get any other idea out of this whole convention except that one idea, the possibility of what you can do by studying your individual cows, and weeding out, and getting a good male of some of the special dairy breeds, your time has been well spent. Do not let any of this all-purpose stuff get in your way, and you will find not only that you are going to get yourself into the way of a good income, but you will think intelligently and win the respect of everybody that knows what you are doing. You are laying the foundation to make yourself and your family comfortable and happy and have the respect of everybody that is worth having the respect of.

Adopt a standard—When you start in this line of work, you should have a standard and make that standard yourself. In different localities there is a difference in the cost of labor and food and what you can get for the product, though not very much, but get at it and make your own standard. Draw your own dead line and then live up to it.

The Bull—Do not forget that the bull is one half of the herd. Some may ask, how is that. It is just here. The heifer calves are most likely to take after the sire and back on the sire's side than on the dam's side. That is where the male is more than one-half of the herd. That is true not only of the bovine family. It is true in a great many cases in the human family. Do not let a few dollars prevent your buying the most desirable male you can buy. When you stop to think of the project, figure up, from the size of your dairy, how many heifers you will get from that animal, and do not sell him until you have learned what he is worth to you. As an illustration along that line, about two and one-half years ago I bought a registered Holstein bull, and the man, from whom I got him, had had him a little over two years and a half and had not tested any of his heifer calves. I had not had him six months until that man called me up and asked me if I were not ready to sell that animal. Right away I was suspicious. I backed right up in the harness and would not sell him at all. He had been testing some of his two-year-old heifers and wanted to buy that animal right back. He didn't use any policy at all about it; he almost fell headlong trying to get him back. Now I prefer to buy a male of a few years use so I can know his get. I would rather do that than to buy a younger one where I cannot have an opportunity to learn what the latter's get is doing.

I remember a few years ago I was up in Wisconsin to a dairy convention. I made a statement something like this, that I cared more for the butter record of the sire's dam than I did for the cow's own dam. Ex-Governor Hoard jumped to his feet and said, "It amounts to more."

There is no part of the work that will pay as well as looking after the individual cow and seeing that the cows are properly bred. The testing must be followed up faithfully. Do not go through your herd and test it once and then lie down and quit, because there will be conditions changing and the cows may change, there will be something happening most all the time, and you want to know when they are at a point that they are not proving profitable. You want to know what you must weed out every year. That is the only way you can improve your standard.

I guarantee any of you people, who will start out with that kind of principles, that you will become facinated with the work. When you have got one year's work done, you will want to follow it up. It is one of the most facinating things on the farm, and we are following it up now, and I will tell you how we are conducting it.

A three-day sampling period—We make a three days composite test (three consecutive days) every month, making it with the Babcock test and keeping the weight of the three days milk every month. It is an exceedingly interesting duty, and especially so to see what the two-year-old heifers, that come in, are doing, and to follow back and see what their dams are doing and what their sires' dams did.

Q. Do you weigh the milk night and morning every day in the year?

A. No, just three days a month, and take the average of the three days, and figure the cow as giving that average for the month.

Q. Is it not advisable to take this test about the middle of the month?

A. I had not thought about taking this test by the calendar month, but if you are going to take it by the calendar month that test is all right.

Q. If a cow would calf the first of the month, no doubt the middle of the month would be all right. Suppose she would calf about the middle of the month, a test at the middle of the month would not be all right, would it?

A. If she calved about the middle of the month, I would let her go to the middle of the next month. If I were making my test at the middle of the month I would test the cow that had come in at the first of the month, but I would not test a cow that had just dropped her calf. You find, when you come to average it up, where these minor points do not amount to much, for the practical dairyman. We do not want to get the thing so cumbersome that people cannot handle it at all. At the National Dairy Show last fall I made some remarks that provoked considerable discussion. I know at one of the institutes in Illinois last fall they had some of Gurler's figures up, and thought he had shot pretty high. I made a statement that a cow that would produce four hundred pounds of butter per year was as well worth four hundred dollars as a cow that would make two hundred pounds of butter was worth forty dollars. I have a few figures here I am going to give you. I will put them on the blackboard.

Example—We will put two hundred pounds of butter at twenty-two cents. I do not believe that is any too high, as a matter of comparison. We have forty-four dollars, and I suppose that cow will make four thousand pounds of skimmed milk. I shall put that at twenty cents, which makes $8.00. Here we have $52.00. We will suppose the cost of feed to be $35.00, which I think is about right. The labor we will figure at $16.00. A few years ago, when I left the farm and figured this thing all out, I figured it cost me per year per cow when milk went to the creamery, about $12.50.

Now labor is much higher than it was then, and I am putting the cost up to $16.00 for labor. Here we have $51.00. We have $1.00 on the right side—just $1.00.

Now, I think you might as well work for $25.00 per month, or for the going wages, which would be $28.00 per month now, as to keep that kind of cows.

Now we will take the four hundred pound cow. We have 400 pounds butter at 22 cents, or $88.00. We have 8,000 pounds of skimmed milk at 20 cents, or $16.00; making a total of $104.00. The cost of feed in this case was $45.00 and the labor $16.00; making a total of $61.00.

We have $43.00 profit, or $42.00 more than we got out of the other cow. Now that $43.00 will pay ten per cent interest on $400.00; almost twice what we can get for our money any other place. Some of you will raise the question that there is more risk. Your loss would be greater if anything happens to that $400.00 cow than that $40.00 cow. Now we go on the other side of that. We have the heifer calves from that cow. We may have three or four that may be her equal, and this certainly more than pays for the risk.

I am now through with the items I had noted here, and it is about time for me to close, anyhow.

Q. I want to ask as to breeding a bull to his own get.

A. I would not do that. Though I have had no occasion for that, because I have had a herd of a size to support two or three males. I do not like to discuss that question. That is a field in itself. I am not well enough informed upon it to go into it.

Here is one point I want to tell you. I have rented my farm now to two men that have been superintendents on the farm, one for three years and the other five years, and one has a son eighteen years old, just out of the township high school, and we are applying this test now. Do you know that young man is so interested he is watching all this work. He is just as interested as he can be. He is going into the subject in earnest, and is to be one of two men, who with six milking machines, will milk the sixty-four cows which we are keeping. I know those men will follow my lead and are going to weed out those cows that are not doing what they ought, and hold the standard up where there will be some money in it for them and for me.

Q. Does it do to mix the dairy breeds?

A. Do not do it. I did that once and I had to pay for It. I bred a Holstein bull to grade Jerseys and grade Guernseys and secured a very uneven lot of heifers, a few were good but more of them were not what pleased me. A Jersey or Guernsey bull may be bred to grade cows with good results.

Q. Do you dehorn your cows? A. We dehorn by simply blistering those little buttons on the head before they adhere to the scalp.

Q. What do you use for a blister? A. Caustic potash.

Q. Would you dehorn a cow with long horns?

A. Yes, it is a humane act. Several years ago I got to dehorning cows and the humane society got after me, but I tell you they got off in a hurry, when I told them a few things.

Q. Do you use a clip or a saw? A. I use a saw, and I generally cut down a little under the skin and start a little blood. They will usually heal right over, so you cannot tell the animals ever had any horns, and sometimes even an expert cannot tell they ever had any. I use a saw, because I think a clip has a tendency to crush the horn.

Q. I want to ask you what influence the feed has on the milk? A. Well, if I live to be old as this man has represented me (3,000 years), I could not find that out entirely. Let us go back thirty or thirty-five years. I was on the farm, making my own butter, and I reached this conclusion: that possibly (I use the word "possibly") I could have the amount of fat in the milk somewhat improved by the condition of the cow, but I was never quite sure of that, and I tell you it is not worth fooling with.

Q. You can increase the milk by that means, can you not?

A. Oh, yes.

Q. Why do so many people think the feed makes the cow give rich milk? Is that possible?

A. I don't think it is. I don't think the food has much influence on the richness of the milk.

THE CARE OF MILK.

(Prof. C. H. Eckles, Columbia, Mo.)

It is a well-known fact, that a great variety of odors and tastes are found in milk and dairy products at different times. Some of these are desirable and some undesirable. In fact, the market value of butter and cheese depends largely upon having the proper taste and odor present and avoiding the objectionable ones.

In order to handle milk intelligently, it is necessary to understand the causes of these odors and tastes, and to assist in this effort, it is helpful to classify the sources under three heads:

1. Absorption from the air.
2. From the cow herself.
    a. Feed.
    b. Sickness.
3. From the action of bacteria.
    a. Souring.
    b. Gassy.
    c. Putrifactire.
    d. Slimy.
    e. Bitter.

Odors from the air—The absorption of odors from the air is a common occurence as every one knows, and so far as I know in no case are the odors absorbed beneficial. Milk, cream and butter absorb odors readily, but cheese very slowly. On account of this characteristic of milk it is necessary at all times to guard against exposing milk or cream to any odor. This means that the barn and surroundings must be free from odors. It was formerly thought and even taught in the dairy schools, that milk would not absorb odors as long as it was warmer than the atmosphere, but scientific experiments showed this to be a mistake, and in fact that the reverse is true. Warm milk absorbs odors faster than cold.

Every retailer knows that he is often blamed for odors and tastes which are absorbed from the refrigerator where the milk is placed by the consumer. The odors of fruit are especially easy of absorption by butter and milk. Injurious effects of odors from absorption are small compared with the injuries from the third class, the bacteria. As soon as milk is taken from the source of the odors, the odors begin to evaporate and are less pronounced after a time. An absorbed odor may usually be driven off entirely by heating from 130 to 170 degrees.

From the cow—The second source of taints in milk is the cow herself. These are of about equal importance with the first class mentioned. The most common of these are the tastes produced by certain feeds. As a rule the tastes due to this source are objectional, although not necessarily so. Just how much ordinary feed effects the taste of milk we cannot say definitely, but probably the effect is slight. Silage, as usually fed, gives milk a slightly characteristic taste which, however, is not objectional and in fact is liked by nearly all milk customers. If people be given milk from silage fed cows after being accustomed to other milk, the difference is often noted and possibly objection made by some. However, no one objects to milk from silage fed cows when they are accustomed to it.

Any feed having a marked taste is liable to flavor the milk more or less, but the most common examples are onions, turnips, certain weeds and green rye. We can understand how these feeds affect the milk more clearly by considering what happens when a person eats onions. For about an hour after eating onions there is no noticeable effect, then the breath begins to smell of onions and soon the taste of onions is in the mouth. The odor of the breath comes from the onion products being given off by the lungs and the taste is due to the onion products coming into the mouth with the saliva. The entire circulation is filled with the volative product and it passes out of the body in every excretion and secretion. The same thing happens when a cow is fed a feed with a strong odor or taste. As soon as it is digested it passes into the circulation and into every secretion, including the milk. By thinking of these facts we can see clearly that a feed liable to give a taste to the milk should be fed either immediately before milking so there will not be time for it to be digested, or at once after milking so it may get out of the body before another milking.

If a cow is sick, has indigestion for example, the milk may have an objectional odor or taste which has been absorbed from the alimentary canal by the circulation. Clean milk from a healthy cow has no cowy odor or animal odor, as is fully believed by many dairymen. The so-called animal odor comes either from an unhealthy animal, or from dirt in the milk.

Any taste or odor that milk has when freshly milked is due to one of the causes mentioned, but further, it should be clearly understood that any odor or taste not present in the fresh milk but developed later does not come from the cow nor her feed. For example, if milk becomes slimy or bitter or smells bad after standing some time, do not lay it on the cow, unless it has the same condition when freshly milked. Taints from the feed are driven off almost entirely by heating the milk. The smell of onions or turnips may be removed almost entirely by this means. In some localities, especially in the South Atlantic States, milk is often pastureized with this object alone in view.

Under usual conditions this source of tastes and odors is of comparatively little importance. As a rule the cow produces milk pure and the responsibility for the many troubles that appear in handling it should be placed where it belongs, on the person handling the milk.

From bacteria—Practically all tastes and odors that develop in milk on standing, and we know there are an infinite number, are due to bacteria. Milk itself has no power of changing in any way. We speak very often of milk souring as if it were the only thing that happens to milk. It is the most common change, but there are several others. One kind of bacteria causes milk to sour, and another produces gas and, if present in large numbers may make the gassy curd and spongy cheese so much dreaded by cheese makers.

Another familiar cause, ordinary decay or putrefaction of milk with the bad tastes and odors common with such changes. These are the cause of much of the bad cheese and butter. Others produce the ropy milk or stringy milk so dreaded by the milk man· The feed of the cow has nothing whatever to do with this stringy milk. It is not uncommon for the milk dealer to be driven out of business by the ropy milk bacteria.

Others produce bitter milk and bitter cheese. Occasionally a factory becomes infected with these bacteria and the cheese may be worthless.

The bacteria which causes these changes in milk are as well known to the bacteriologist as are wheat and corn to the farmer. He separates them, grows them and studies them. The success of the dairyman depends largely upon how he treats these bacteria, although he may not even know there is such a thing. This is especially true of the butter maker and cheese maker. Under ordinary conditions the butter, whether it be good or bad, depends upon the kind of bacteria which have developed in the cream, and to only a slight extent on the feed of the cow.

The first principle in handling milk, and perhaps the most important, is to keep out as many bacteria as possible. This requires care and attention to a great many details, but it may all be summed up in one word—cleanliness. Wherever there is dirt or decomposing matter, there we have bacteria. Most of the dirt, and therefore most of the bacteria, get into the milk during the process of milking. The cow herself is the chief source of the contamination to which milk is subject. Especially is this true when the cow is kept under the conditions found in some barns. The cow must, first of all, be kept decently clean, if it is expected to produce milk suitable for human food. In many cases the difficulty is to be attributed to the poor arrangement of the barn. Put the cow in a well lighted stable with good floor, a platform the proper length to stand upon, a suitable gutter and a manger, and it is possible, at least, to keep the conditions fairly good. Then keep the cow decently clean. Curry her and brush off the udder and adjoining parts of the body with a stiff brush before milking.

Do not depend upon a strainer to take out the dirt. Straining milk does not help the conditions of the milk in the least, except in appearance by removing the visible dirt. It does not keep an hour longer when strained than it does, if not strained. My students have demonstrated this to be a fact several times. The only way to have clean milk is to keep it clean in the first place.

Next to dirt in the barn comes improperly cleaned utensils as a source of contamination. A single dirty can may contain more bacteria than there are inhabitants in the world and as soon as milk is placed therein they are all ready for business. In cleaning utensils a brush is the only proper thing to use, a dish cloth is not only unnecessary but should not be allowed to be used in cleaning pails, cans or cream separators.

All these and many more details are covered by the one word, cleanliness. Cleanliness is keeping bacteria out. But in spite of the best efforts at cleanliness many bacteria will find their way into milk. If we wish to have milk or cream to keep in good condition some time, we must check these bacteria from growing. The only practical harmless method of doing this is cooling. To get the real benefit of cooling, it must be done at once, after milking. It is very important that it be not delayed. Milk cooled at once to 60 degrees even, and kept there, will usually remain sweet 48 hours or longer. Of course the most effective cooling means reducing the temperature to 50 or under.

When cooling milk care should be taken that it really is cooled. It will not do to set an 8-gallon can of cream in a tub of well water and think it properly cooled. A thermometer should be used often enough to make sure that the cooling really is effective. One of my students recently made an experiment that showed this point very plainly. He took two eight-gallon cans of milk, one he cooled to 50 degrees, the other was uncooled. The two were placed in a room at a temperature of fifty-five degrees. The cooled sample remained sweet six days; the uncooled soured in 48 hours.

Cleanliness and coldness are the two great principles to remember in handling milk.

MILKING MACHINES.

(Prof. O. Erf, Manhattan, Kan.)

Owing to the great progress that has been made in the dairy industry within the last few years, there has come such a great demand for milkers that dairymen are unable to secure them at a compensation that will allow a fair margin of profit. The confinement and nature of the work frequently make milkers discontented and cause them to seek other work which perhaps is more pleasant to them. With this condition—one of the greatest drawbacks in the dairy business—it is quite essential for many dairymen either to discontinue the dairy business or to secure an apparatus that will do the milking, for this seems to be the most objectionable part of the dairy business.

Within recent years a great many inventors have exerted their energies in this direction and milking machines have been invented that are practical under present existing conditions. The introduction of milking machines has become a popular subject for discussion, and it is plainly evident that it will be a marked stimulus to the dairy industry.

DIFFERENT KINDS OF MACHINES ON THE MARKET AT PRESENT.

There are a number of milking machines on the market at present time, many of which have objectionable points and need to be improved. The Burrell-Lawrence-Kennedy machine, which is now manufactured by D. H. Burrell & Company, Little Falls, N. Y., is the machine that has been used largely at our station, and has proven to be one of the most successful and simple machines. The Globe machine has also been tested at this station, but it has not proven to be as practical and seems to be a little more difficult to regulate than the Burrell-Lawrence-Kennedy machine. A number of other machines are being tried, but are not yet ready to report on them.

THE CONSTRUCTION OF MILKING MACHINES.

The Burrell-Lawrence-Kennedy machine consists of the following parts:

(1) An appliance for creating vacuum. There are various kinds, and they can be operated in different ways.

(2) A vacuum chamber.

(3) A gauge.
(4) A regulator.
(5) A pipe system.
(6) The milkers.

There are three ways of producing vacuum. First, by means of a vacuum pump, which can be operated by any motive power. Second, by a steam air exhauster. Third, by means of a water vacuum pump. The vacuum pump is constructed similar to that for an air pump, except that the mechanism is some finer and the valves are more closely fitted and especially designed for pumping air. This pump can be operated by means of a gasoline engine, steam engine, bull tread power, sweep power, or electric power, or in fact any form of power that is practical on a farm. A bull tread power is by all means the cheapest, but it requires considerable diligence to train an animal to produce a steady and uniform power.

A vacuum produced by means of a steam air exhauster has proven to be a very practical thing for the average farm. It is simple in machanism, not easily broken, and works with certainty, providing there can be steam generated. The same principle involved in drawing water by means of steam can also be used in drawing air, except that it needs a slight change in the arrangement of the steam jet in relation to the exhaust chamber. The vacuum can also be produced by means of a vacuum water pump. Owing to the large amount of water and the great pressure necessary, however, it is hardly possible to produce vacuum economically with this style of pump.

The purpose of the vacuum chamber is to keep a constant supply of vacuum on hand and to provide for the rush of the air through the teat cups in the case of putting on or taking off the cups from the teat.

The vacuum gauge shows the number of inches of vacuum necessary to draw the milk. The safety valve regulates the vacuum pressure so that it will not become too high. An excess of vacuum will injure the cow's teat, hence in order to maintain a constant pressure this regulating valve is very essential.

It is very important that there should be a steady and constant vacuum during the milking operation. Dairymen well know that in the case of hand milking if one were to stop for a time when the cow is partially milked and then begin again and finish, the chances are that there would not only be a decrease in the yield, but the milk would be of poorer quality. A similar effect is produced in the case of machine milking. If the engine or whatever power is employed to work the pumps stops during the milking operation there is a marked decrease in the yield of milk.

The pipe system consists of the pipe which runs in front or behind the cows. This pipe system contains the vacuum cocks, which are placed between the cows taken in pairs, and to which the milkers may be attached. The vacuum pressure is conveyed through these pipes to the milkers.

The milker consists of a can or receptacle with a close fitting cover, pulsator, and two stop cocks, to which are attached rubber tubes which are connected to the teat cups. The parts of the milker consist of the pail upon which is placed a cover containing the pulsator, and the inspection glass for determining when the cow has been milked dry. There are two milk cocks on each cover, and attached to these are rubber hose which lead to the cow and to which the teat cups are connected. A rubber hose connects the vacuum pail with the vacuum cock, allowing the suction to be communicated to the pail. By opening the vacuum cock the air is exhausted from the pail, which sets the pulsator in operation. As the pulsator works up and down, it applies suction to the teat and then gives a relief. When suction is applied it draws the milk through the milk tube from the teat and deposits it in the pail. The peculiar construction of the teat cups assist markedly in making the machine a success. These teat cups are made of tinned copper, the tops of which are fitted with a flexible rubber mouth-piece which adjusts itself to the condition of the teat and thus seals the air from the vacuum. To milk thoroughly a teat cup must fit the teat perfectly, and it is here where the success of a good operator comes in to determine what teat cup to use for each individual cow.

THE FITTING OF TEAT CUPS AND MOUTH PIECES.

The teat cup of a machine is that part which is made of tin and surrounds the teat, and in fitting the same to the teat it must be of such diameter as to receive the teat loosely during the latter part of the period of lactation, and should fit rather tightly in the first period of lactation. The chief objection to a teat cup that is too large lies in the fact that the vacuum expands the teat and thereby draws the milk down into the teat, but the pulsation is as a rule not of sufficient duration to allow more than a part of the milk to flow from the teat. As the release comes on, the pressure of the air causes the teat to collapse and force the milk back into the cistern. Hence, by having too large a teat cup the milk is churned back and forth in the teat and milk cistern. If the teat cup fits the teat snugly, it prevents the teat from expanding, and the vacuum being exerted largely at the lower end of the teat, the milk is completely removed from the teat at each suction period.

The slant of the teat cup must be duly considered, for the reason that if the teat cup is fitted too loosely at the apex a large amount of blood rushes to this point and causes a temporary inflammation, frequently producing sore ends. This can be entirely avoided by fitting the cup so that the apex of the teat is similar to the incline of the teat cup. If the teat cup is too small the milk flow is obstructed, and consequently the milk will not all be removed. The mouth piece should be large enough to allow the free flow of milk into the teat, and in case the cow is advancing toward the latter part of the lactation period the mouth piece should fit so loosely that at the end of the milking operation it is necessary to tie it up. If due precautions are taken in these points, the teat cups will completely remove the milk.

CLEANING OF MACHINES.

The milking machines are very easily cleaned if a systematic operation is followed, first, by attaching the machine to the vacuum and allowing it to rinse itself with lukewarm water, and then with a boiling solution of sal soda or some washing powder. In the Burrell-Lawrence-Kennedy machine only the milker needs to be cleaned. The tube is then removed, and the can is washed and thoroughly sterilized. The pulsator is taken apart and cleansed with a rag, and then placed in the sterilizer, the same as the can. The rubber tubes, which are the hardest part of the machine to keep clean, are then scoured by passing a brush through them and laid in a brine solution. It is very essential that rubber should be kept wet, and by adding salt to water it acts as a preservative and prevents fermentation. These tubes are then rinsed with boiling water and the machine is again ready for operation.

THE KEEPING QUALITY OF MILK.

Milk produced by these machines, if properly cleansed, contains from 60 to 80 per cent less germs per cubic centimeter than ordinary milk secured by hand. It is, therefore, extremely desirable and practical from a sanitary standpoint to produce milk with one of these machines.

LABOR.

One milker milks two cows at one time. One milker will milk ten to twelve cows per hour, depending somewhat upon the kind of cows and the amount of milk they are producing. The average rate of hand milking is from six to seven cows per hour. Taking all conditions into consideration, a machine milks as fast or a little faster than the average hand milker.

Any number of machines may be applied to a system. Four milkers can be easily operated by one man, thus milking eight cows at a time. Estimating all the labor included in starting the machine, taking care of the pumps, setting up the milkers, transferring the milkers from one cow to another, and cleansing the machine, fully 40 per cent of the labor is saved by using a machine.

The nature of the work is another factor which should be taken into consideration. By the use of the milking machine the monotony of milking is to a great extent removed. The work becomes easier and more pleasant.

THE EFFECT MACHINE MILKING HAS UPON THE COW.

Machine milking is very much easier on the cow than hand milking, for the simple reason that the suction being applied upon the teat is not as painful as the pressure applied by the hand, and the movements of the hand are not as steady and as uniform as the movements of the machine.

POWER WITH WHICH TO OPERATE MILKERS.

It is never advisable to operate a milking machine plant with less than two milkers. In this case it requires about a two-horse power gasoline engine. Gradually, as the number of milkers is increased, the proportionate power may be decreased. Instead of calculating a horse power to every milker, a five-horse power engine may easily operate eight milkers.

COST OF A MILKING MACHINE.

We deem it essential to use power in connection with a milking machine. This, to a certain extent, will make the use of a milking machine impractical for dairies having less than eighteen or twenty cows as far as profit is concerned. We would, therefore, suggest that farmers who are keeping a less number of cows should either inrcease their herd or decrease it so as to make it practical for hand milking.

The cost of equipment for a milking machine depends somewhat upon conditions. At the present time the equipment required to milk a herd of fifty cows in two hours would be as follows:

1. Three milkers, costing $225.
2. Piping for the barn. This depends somewhat upon the kind of cows and upon the price of labor. Ordinarily it costs about $30.
3. A vacuum tank, similar to those connected with the ranges or kitchen stoves, costing from $10 to $12.
4. If the milker is to be operated by means of a vacuum pump, the pump would cost $75.
5. The motive power, if it is gasoline, would cost for a two-horse power gasoline engine about $110. For a steam engine, $150. For a tread power, about $75.

If we take the gasoline engine and the vacuum pump into consideration, the total cost of the milker would be $450. If a steam air exhauster is used, a boiler can be purchased for $100 and an air exhauster for $25, making a total cost of $400. For a dairy of twenty cows, with two milking machines milking two cows each, or four cows at one time, the cost would be about $16 per cow. For a herd of forty cows it would cost $12; for a herd of fifty cows it would be $9; for a herd of sixty cows it would be $8.50. The above figures are approximate, taking average conditions into consideration.

HARD MILKING COWS.

Cows that are hard milkers, but those that have small teats, are milked more easily and more quickly by a machine than by hand. With a hard milking cow it is simply a question of keeping the machine at work a little longer, and with a small teated cow care should be taken that the teat cup is properly fitted. Occasionally a cow, for some reason or other, refuses to give down her milk. This does not seem to be due to the nervous temperament. It is possibly true that the change from hand to machine milking is too radical for those particular individuals, and it takes some time for them to become accustomed to the change. Such cows do not make any objection to the machine being applied to them, but simply stand still and allow the machine to pump away without withdrawing any milk. As the cows that give this trouble are few in number, it is better for the dairyman to dispose of them.

COWS THAT KICK.

With cows that are in the habit of kicking during the time of milking the habit has been frequently broken by the use of the milking machine. As a rule, the kicking cow gives less trouble when milked by machinery than when milked by hand.

THE BUSINESS END OF TUBERCULOSIS AMONG CATTLE.

(D. F. Luckey, State Veterinarian.)

In order to confine ourselves to the discussion of the subject assigned to me today, it will be necessary to avoid any extended reference to the disease of tuberculosis or the tuberculin test. For those who desire further information on thes subjects there is plenty of literature in print ready for free distribution. On page 354 of the 38th annual report of the State Board of Agriculture will be found a brief discussion of the subject of tuberculosis, including an explanation of the tuberculin test. The August, 1905, bulletin of the Missouri State Board of Agriculture contains a detailed explanation of the tuberculin test. Besides these publications there are any number accessable to anyone who desires information on these subjects.

To illustrate briefly the proposition that the dairymen of this State have to deal with, I will call your attention to the experiences with different herds which have been affected with tuberculosis. The college herd of Cornell University, New York state, was for sixteen years kept free from tuberculosis by the use of the tuberculin test on every animal added to it. In the course of time the herdsman concluded that the precaution of testing each animal added to the herd was unnecessary, and neglected to use it on four animals which were added. These animals, it is true, were accompanied by a health certificate alleged to have been made by some unofficial veterinarian. It is more than probable that the examination consisted in looking over the animals about as the ordinary dairyman would do in considering his purchase. At least some few months after these four head were added to the herd, one of them was found to be diseased in some way. The tuberculin test applied to these four cows revealed the fact that they were all diseased with tuberculosis, and on testing the whole herd it was found that four more of the healthy cows of the herd had become diseased. Another good example is in the handling of the Missouri Experiment Station dairy cattle. Even under the eyes of trained veterinarians it is necessary to test all animals added to this herd to make sure that tuberculosis is not getting started among the cows. When new animals are purchased to be added to the herd it is not considered sufficient for them to pass an ordinary examination by the herdsman and the veterinarians in charge of the Station, but it is the invariable rule to apply the tuberculin test to all new stock. Two years ago, in a small lot of cows to be added to the herd, one fine looking, high-priced registered Holstein cow reacted to the test. Instead of adding this apparently healthy but diseased cow to the herd and allowing her to spread tuberculosis among the cattle therein, she was slaughtered. Post-mortem examination revealed the presence of tuberculosis. A test of the entire lot of dairy cattle at the Experiment Station in May, 1906, showed the presence of no tuberculosis. In the fall of 1906 some Ayrshire cows were purchased in New York state and brought to Columbia. Before putting them into the herd they were tested with tuberculin, and one of these cows reacted to the test. Another example showing about what misfortune is liable to happen to the average dairyman over the State is one in which an ex-member of the State Board of Agriculture, and a man of average intelligence, met with some severe losses. Notwithstanding that he had long experience with dairy cattle and was a good judge of cows, he made a fatal error in buying up cows for his dairy herd. Although using his best judgment and paying liberal prices for apparently healthy cows, he did not prevent the introduction of tuberculosis into his herd. A test of his herd on March 16 and 17, 1906, showed the presence of 27 tuberculous animals in a herd of 78 cattle. About 20 head of these cows were giving milk at the time of the test. A post-mortem was forthwith made on one of the cows which showed the most doubtful re-action, which demonstrated the presence of the disease. Later in the summer another cow, which was at the point of death with tuberculosis, was slaughtered and found to be badly diseased. Specimens from both cows are being preserved at the Missouri Experiment Station. Of the 20 cows which re-acted to the test five were showing well-marked symptoms of disease; 15 were not yet sufficiently advanced to create suspicion and might have been sold as healthy cattle. Although a notice quarantining all of the diseased cows was served upon the owner, he has continued from March 17, 1906, up to the present time to ship their milk to the city of St. Louis, where it goes in with the general milk supply of the city. There seems to be no law in this State under which the sale of milk from tuberculous cows may be prevented. A letter addressed to the Attorney-General, asking whether or not anyone had any authority to prevent the shipment of milk from these cows, has never been answered. There are two great objects in mentioning these cases. The first is to thoroughly convey the knowledge that any dairyman who trusts to his own judgment and neglects the use of the tuberculin test stands a good chance, sooner or later, to get tuberculosis among his cattle; the second is to show that there is a limited amount of tuberculosis scattered through the herds of this State, and dairymen may well infer from the examples mentioned that it is only a matter of time till the disease will become as common as it is in older states and in European countries. A sufficient number of tests of dairy cattle have been made over the State to show that the milk from tuberculous herds is going into the general supply for the cities of St. Louis, St. Joseph and Kansas City. Dairymen cannot afford to have a few people with diseased cows to carry on a business which reflects upon the whole dairy industry of the State. The necessity, therefore, of looking after the spread of tuberculosis in dairy cattle, from a business standpoint, becomes imperative.

The loss of the cows that die of tuberculosis is a comparatively small matter. The greatest loss is due to the decreased price which dairymen must in general accept for their products, resulting from any inferiority in quality, whether from disease or lack of cleanliness. The discussion of the subject of tuberculosis in the human family and lower animals is just well started. The people of the cities who purchase the dairy products of the State are the ones who are doing the most reading and thinking about this matter. They are rapidly learning the danger of tuberculosis, and naturally desire to shun it. They demand, and have a right to demand, dairy products that are clean and free from tuberculosis. The average dairyman today, who is careless about handling his milk and allows it to become saturated with filth and who takes no precaution to prevent disease among his cattle, is compelled to sell milk in the cities at a small profit, if he gets any at all. From personal observation I know that some dairymen have gone out of the business for the reason that they cannot get enough for their milk to pay for producing it. At present prices of feed and labor they say that they must have twelve cents a gallon for milk during the summer and sixteen cents in the winter. During the past summer ordinary milk has been wholesaling as low as ten cents a gallon in St. Louis. At the same time the wholesale milk dealers, at least in one case, have offered to contract for milk known to be of a good quality from a certain dairy at thirty-five cents per gallon for ten years. The stipulations in regard to the dairy were those known to be required in order that the owner might use the copyrighted terms "certified milk." They were by no means beyond the reach of an intelligent dairyman. What is known as certified milk has been retailed in St. Louis for the past year at fifteen cents a quart or sixty cents per gallon. The only reason that dairymen are required to accept unprofitable prices for their milk is that the public has not enough confidence in its cleanliness and its being from healthy cows. This is mentioned to show that from a financial standpoint it will pay the dairymen of the State to take any step necessary to thoroughly rid the dairy cows of tuberculosis and raise the standard of milk. I believe it is fair to estimate that if it were generally known that dairies are conducted in a cleanly manner and every precaution taken to prevent disease, that the price of milk would soon double and the demand be much greater, even at the advanced price.

For the past seven years the subject of tuberculosis has been discussed in this State, in season and out. Bulletins giving accurate information on the subject have been distributed without limit. The subject has been discussed before hundreds of farmers' institutes and a number of times before the State Dairy Association. In August, 1905, a bulletin explaining in detail the use of the tuberculin test was published and twenty thousand copies put in the hands of the cattle owners of this State. This bulletin offered the services of the State Veterinarian and his assistants to the owners of permanent herds in making careful and scientific examinations of their cattle and without any charge. Up to the present time only about twenty-five dairymen have availed themselves of this offer; a number of these were solicited to do so. It is no exaggeration to say that the dairyman of the State are apparently sound asleep on this particular matter.

The great question arises, What are you dairymen going to do? The whole matter rests with you. It is not the intention of the veterinary department of this State to force the inspection of your herds upon you against your will. We simply want to let you know that the veterinary service is at your command, and that every effort will be made to assist you in preventing the spread of tuberculosis among your cattle. It does not seem proper that any

State department should assume to dictate to you on this matter. The first impulse of the dairymen will naturally be to stop the discussion of the subject of tuberculosis. I am afraid that some of you will blame me for saying anything further about it, but you must understand that this is a matter now too well understood for the truth to be suppressed. Even if I were never to say another word about tuberculosis of cattle, the facts, as they exist, are bound to become public from time to time and bear their evil results. Even though I were to say nothing further, it is a case of "Truth crushed to earth will rise again." In all of the discussions of this subject I have tried to avoid sensationalism and in every respect to be conservative. More than that, I have planned diligently to get about the control of tuberculosis of cattle without causing the owners of herds any unnecessary loss, either from animals sacrificed or from damage to the reputation of the dairy products. Anyone who will read the August bulletin of 1905 carefully will know that these facts are true, regardless of the many allegations of those who are opposed to any aggressive campaign against tuberculosis, and who would probably rather let future generations handle thousands of head of tuberculosis cattle and use their milk than to sacrifice a few head at the present time.

There are a few serious obstacles in the way of the control of tuberculosis, and the business end of the matter comes down to the serious and practical consideration of these by the dairymen. One thing that makes the use of the tuberculin test unpopular is that it shows animals to be diseased which to the average eye appear healthy. In rare cases a mistake may be made and an absolutely healthy animal condemned for tuberculosis. I believe that a liberal estimate of the errors that will be made in the use of the tuberculin test by a man of good judgment is one out of one hundred. When properly considered, the actual mistakes are so few as to be of very little importance. If a man had ninety-nine diseased cows in his herd, and if, in order to get rid of them, a mistake were made and the one hundredth healthy one was sacrificed, that this would still be better than to leave ninety-nine diseased cows in the herd. The sacrifice of the healthy looking cows is the hardest proposition for the dairymen to face, yet in the case of the Missouri State Farm herd, the sacrifice of one healthy looking but diseased Holstein cow prevented the inevitable loss of ten or fifteen more by the end of the year, and probably the general spread of tuberculosis in the State herd. I admit, however, that it will take considerable confidence on the part of dairymen in the tuberculin test for them to willingly part with cows which are in the earliest stages of the disease and show no external symptoms.

Mr. H. B. Gurler:

Mr. President—Perhaps my experience with the tuberculin test for ten years might be of interest to some of you. At the time I started in the certified milk business I had my herd of 130 animals tested with tuberculin by the State board of live stock commissioners. We found 3 per cent to react, and at the post-mortem the disease was visible in all.

I knew of a case in McHenry county, Ill., where a cow reacted, and at the post-mortem no trace of the disease was found, but a guinea pig that was inoculated with this cow's milk died with tuberculosis. I find that I cannot detect the disease of tuberculosis in its early stages by outward appearances. I remember buying three cows from a dairy where I had every opportunity to examine them, and when we applied the tuberculin test two of the cows reacted and were slaughtered, and found to be much affected. I well remember a newly appointed official of the State board of live stock commissioners passing judgment on some of my cows in advance of the tuberculin test, being very confident that he could tell a tuberculous cow. But not one of the cows he selected reacted to the test. After ten years with the tuberculin test I have come to have great confidence in it, believing it to be as near infallible as anything we have to deal with. I cannot prove that it detects all the tuberculous animals; but in all cases the animals that have reacted to it have proven to be tuberculous.

Dr. Luckey: The greatest problem for the dairymen to consider is the disposition of diseased cows. In all states it has been a very difficult matter to arrange for the disposition of cows reacting to the tuberculin test without working a hardship on someone. Many of the cows which react to the test are too good to slaughter, yet dangerous to keep in a dairy herd. Their milk is unfit for human food, yet many of them, after reacting to the test will put on flesh and lead the average dairyman to believe they are healthy. This fact should be thoroughly established in the minds of dairymen before they go about arranging any general campaign against the spread of tuberculosis. It is hardly possible to suggest a satisfactory plan for disposing of re-acting cows. In some states they are shipped to slaughtering plants having Federal inspection, and if the lesions are found not to have developed beyond certain limits prescribed by Federal meat inspection, their carcasses are passed for food.

The carcasses of those in which the disease has spread from one organ to another are condemned by the meat inspectors and thrown into the rendering tank and made into fertilizer. It is questionable whether or not, if this were generally known, the practice would be tolerated by the public, yet according to the best authorities this practice is a safe one. It does seem that if cows which have reacted to the test were properly branded and marked and sold as diseased with tuberculosis and given an especially close inspection at the time of slaughter, it might be possible to dispose of them by sending them to the public markets. It is now the practice of those who have tuberculous herds to ship all animals that become advanced with the disease to the public markets for slaughter. These animals are sold without any warning to anyone, and the public is protected from their use as food only by the meat inspectors. Compared with this practice, the one of sending reacting cows duly marked to the market to be slaughtered would be a very safe one indeed. On the general principle that the suppression of the contagious disease is for the public welfare, the public should willingly bear at least a part of the loss when animals are condemned. Horses affected with glanders are now condemned and killed and an allowance to the owner is made by the State. The same law does not apply to cows affected with tuberculosis, but it might be well for the dairymen to ask the Legislature to extend the provisions of the law to cover tuberculous cattle. This provision is justly due the dairymen, and I am satisfied that any organized effort to secure it would prove successful.

Another problem worthy of consideration in dealing with tuberculosis, but one very favorable to the cattle owners, is the possibility of immunizing young cattle against this disease. The great von Behring, who discovered diphtheria anti-toxin, which has saved so many lives from diphtheria, has led the way in immunizing cattle against tuberculosis. Other able men are at work on the subject, and it is only a question of time until the successful immunization of cattle against tuberculosis promises to be an accomplished fact. This is a thing which the owners of registered dairy cattle and valuable strains of milk stock may well take into consideration in planning for the eradication of tuberculosis.

Summing the matter up, we find that the business end of it consists in the dairymen finding out, first, which cattle are tuberculous, and second, some satisfactory arrangement for disposing of them. The first question has practically been settled by the offer of the State Veterinary Department to make a test of all permanent herds of the State. The second question must be worked out by the dairymen themselves. Although having given the matter of disposing of tuberculous cattle a great deal of thought, I have not yet been able to arrive at a practical solution of this question. I stand ready at any time to advise with the dairymen and help to plan the matter, and would be more than glad to do so. Some of the herds which were found diseased were located in St. Louis county. I took the liberty to ask the representative of that county to study the actual conditions existing among his constituents and draw up a bill covering the situation and present it to the Forty-fourth General Assembly. After advising with the owners of herds and giving the subject of tuberculosis some very intelligent study, he prepared a bill which provides in brief that it shall be necessary for every dairyman in the State to secure a license from the county clerk of the county in which he resides, and that the license be granted him only after he has had his herd tested and secured a certificate of health. The bill, as drawn, provides for the State to take charge of all reacting cows and pay the owner $15.00 per head. In the main, the ideas embodied in this bill are correct, and even though it would be put into force at considerable expense, the cost at the present time will probably be not more than one-tenth what it will be five or ten years hence. For two reasons, however, it does not seem advisable to undertake a sweeping result of this kind at this time. The first is that the disease is not well enough understood by the owners of dairy herds, and the second is that it would be impossible to secure competent men to do the work of inspection of herds. The execution of this plan will naturally be met with more or less opposition, and a few mistakes made by inexperienced veterinarians would threaten the success of the work. It seems to me that for the time being a good plan is for the dairymen to simply get the Forty-fourth General Assembly to add the word "tuberculosis" to sections 10548 and 10549 of the present law and for the next two years, at least, dispose of reacting cows by having them appraised under the authority of the county courts, as is now done in cases of horses with glanders. It seems that it would be much better to take time enough to go at this matter right and with due care, than to go to any extremes. As I have said, the whole matter is with the dairymen, and the State Veterinary Department is ready and anxious to do the work.

THE ECONOMICAL PRODUCTION OF CERTIFIED MILK.

(B. D. White, Washington, D. C.)

The word "certified" may be new to many of you as it is applied to milk . To give you a comprehensive idea of what is meant by certified milk, I will say it is simply milk and nothing else; pure, clean, sweet milk, free from foreign matter, and practically free from bacteria. A standard of purity has been established in several states describing just how pure and how free from bacteria milk must be to be allowed the use of the name "certified." In order to use this name one must have the O. K. of the medical society in the county in which the milk is being sold. The medical society of a county form a milk commission, which is composed of members (physicians) who have given the subject of pure milk more or less attention. This commission is composed of a chairman, secretary and several willing boosters; men who are willing to devote some time without remuneration. This commission formulates rules under which milk is produced. These rules read something like the following:

1. A bacteriologist in the employ of the ——— Board of Health shall procure a specimen of the milk from the dairy or preferably from the delivery wagons at intervals to be arranged upon between the commission and the ——— board of health, but in no case at a longer interval than one month. The exact time of the procuring shall be without previous notice to the dairyman. Milk thus collected shall be tested as to the number and nature of the bacteria present. The milk shall also be examined microscopically for the presence of pus cells or other objectionable extraneous substances. Milk free from pus and injurious germs and not having more than ten thousand germs of any kind or kinds to the cubic centimeter shall be considered up to the required standard of purity.

2. A chemist in the employ of the ——— Board of Health shall make analysis of the milk to determine the percentage of proteids, fat, sugar, mineral matter and water present, at similar intervals as those prescribed for the bacteriologist. Test shall also be made for the chemical reaction and specific gravity, as also for the presence of foreign coloring or other matters or chemicals added as preservatives.

Standard milk shall have a specific gravity ranging from 1.029 to 1.034, shall be neutral or faintly acid in reaction, shall contain not less than from 3.5 to 4.5 per cent proteid, from 4 per cent to 5 per cent sugar, from 3.5 per cent to 4.5 per cent fat, and shall be free from all contaminating foreign matter and from all addition of chemical substances or coloring matters.

Neither milk nor cream shall have been submitted to heat before the examination has been made.

When milk is produced that comes up to this standard the medical society grants a certificate, the purport of which is printed on paper discs about the size of milk bottle caps, or other forms which are usually placed on the top of the caps in the bottle. This certificate reads something like this :

The Clover Hill Dairy having complied with all the demands of the ——— county milk commission is hereby granted a certificate to that effect. This certificate is good until February 1, 1907.

(Signed) ———————, Secretary.

The milk commission usually works in conjunction with the city or State Board of Health, and some one is detailed to take samples from the wagons of the persons distributing the milk at irregular intervals unknown to the producer or distributor. These samples are subjected to the necessary tests and the results reported to the producer. If the milk continues to run below the standard for more than a few weeks the certificate is revoked and the milk can no longer be sold as certified.

Now as to the production of certified milk. Unfortunately for the progress of this branch of the dairy industry, extremely wealthy men own most of the certified dairies, and the manufacturers of the apparatus largely used in these dairies took advantage of the opportunity and included thousand of dollars worth of apparatus and increased the fancy equipment with the erection of every plant, until the dairy building of a certified dairy farm is filled to overflowing with coolers and pipes and pans and conductors and strainers and elevators and cables and sterilizers and apparatus too numerous to count. In fact, there was so much apparatus for the milk to flow over that I found it impracticable as well as very costly, and it required about three times as much help as any business of that kind could stand; besides, it was difficult or practically impossible to trace the causes of the high bacterial count. After worrying along for six or eight months we discarded most of the fancy equipment and wanted to discard more. We then produced milk under simple but sanitary conditions, such as any dairyman could afford, and by so doing lowered the number of bacteria several thousand to the c. c.

In January the average number bacteria was	18.25
In February the average number bacteria was	13.75
In March the average number bacteria was	12.00
In April the average number bacteria was	21.20
In May the average number bacteria was	10.26
In June the average number bacteria was	9.35
	84.81

Or an average of 14.13 for six months, and all of these samples were plated at least 36 hours after the milk was bottled, and some when it was 60 hours old—it being held by the Board of Health. We have heard of certain dairies that produced milk with an average number of bacteria of only a few hundred per c. c., but an investigation revealed the fact that the samples of milk were taken from the milk pail immediately after it was drawn from the cows and plated at once. Results of this kind cannot be compared with those obtained in a fair manner.

I shall now endeavor to outline what, in my estimation, is the proper method to pursue to produce certified milk economically. The first thing to be considered is the location of the farm, which should, if possible, be within driving distance of the city or town in which the milk is to be sold, because transporting milk in cases by express is expensive and the breakage of both filled and empty bottles is terrific, and the possible delay of trains, the extra labor and expense of drawing goods from the depot to the place of distribution; besides, the maintenance of a place from which the goods are distributed. If this is not possible, then the dairy should be located near a railroad or trolley line with good shipping facilities as near the trade as possible.

The location of the buildings is the next consideration which should be given most careful consideration. I would recommend that they be located on an elevation which would afford good drainage. The next is the number, style and size of the buildings, consisting of a barn, an ordinary structure for hay, grain and building for the dry cows and young stock, and room enough for the horses necessary to carry on the farm work; also storage capacity for hay and grain for the same and a one-story cow barn, a modern, sanitary, well ventilated and well lighted building, which need not be expensive. This may be so built that it can be enlarged if desired without inconvenience or much expense. Then comes the dairy room, where the milk is cooled, bottled and stored, and where the empty bottles are washed, sterilized, etc. This building has been given so much importance and many have spent from $10,000 to $50,000 in such structure, and I here show you a plan of a building if constructed of wood with cement plastering will cost about $1,700, and if built of brick would cost about $2,000. I have taken into consideration the average cost of building material in different parts of the country. All the equipment necessary is a cooler, sterilizer, bottle washer, a small boiler and a few other utensils.

I wish to draw your attention to the fact that the more apparatus there is in such a plant the greater the danger of contamination, and the less unnecessary apparatus the less danger of contamination, and the easier it is to trace troubles. For instance, when we had in use all the utensils furnished by the machine men and the bacterial count ran high, we could not lay the blame on any one. The men in the dairy would say their work had been performed as usual, and the men in the barn would claim the same thing; but with the simple apparatus I have shown you, there is only one place to watch, and that is the barn; if the work is done carefully at that point, good milk will be produced every time.

Now as to the cows for a certified dairy. So far as the appearance goes, thoroughbred cattle will please the eye of the public, but I would advise keeping common cows. 1st, because a person having a herd of thoroughbreds is anxious to get as many as possible into the advanced registry, and the extra washing the cows should get in a certified dairy seems to affect the flow of milk to some extent, and if a valuable cow loses a part of her udder the owner does not want to dispose of her, and in course of time the milk yield would be diminished; but when only common cows are kept, and one has a defect, she can be disposed of and another put in her place, and it is much easier to keep up an even flow of milk with a common herd than with a thoroughbred, and an even flow of milk is very essential, as the class of trade that uses certified milk is not the kind that will be put off with the simple statement that the cows have gone dry. That class of trade will either take the milk all the time or not at all.

FEED FOR THE COWS.

Cows must be fed somewhat differently when certified milk is produced than ordinarily, as that class of milk is largely consumed by infants, and necessarily must be good, or the reputation which such milk has in order to sell for a higher price would soon be destroyed and the trade lost. The condition of the cows regulate the condition of the children consuming the milk; therefore, a change of feed, or too much feed of a certain kind, especially such as green oats, clover, alfalfa, corn or sorghum, which must be fed with caution; and when a change is made from one to another, it should be made gradually, and my experience has taught me that some dry feed should always comprise part of the daily ration. I have in mind one incident that cost me many an hour of worry and several days of investigation before the trouble was located. We started to feed green corn in August, and in a few days we had numerous complaints from our customers that something was wrong with our milk; that it made their babies sick. Not knowing that the effect of feed has such a wonderful influence on small children we were at a loss to know the cause, and, in fact, discredited the claims of the customers; but finally a well known physician became hostile, and advised his patients to discontinue using the milk from our dairy. By that time we had found and overcome the trouble. This was an expensive experience for us, and I am giving you the benefit, so if any of you ever engage in the business you will not make this error.

CARE OF THE COWS.

Having a sanitary barn to start with, it remains for the dairymen to produce the results. The cows should be tuberculin tested, and if there are any reactions the animals should be removed immediately and the barn fumigated with formalin tablets, after washing stalls, walls and floors with a 4-per cent solution of carbolic acid. The cows should be made as comfortable as possible, but should be given as much fresh air and exercise as conditions afford. It is recommended by some that the cows should not be turned out to pasture, but it is my contention that there is no way of feeding the cows so satisfactory as letting them out to pasture; however, it may be advisable to sow some kind of soiling crop to have it on hand in case of short pasture, etc.

Silage may be fed in the production of certified milk, but care should be taken and not over feed, and to reduce the amount as soon as the slightest indication of a silage flavor can be detected. It has been my experience that ordinary cows will consume about 40 pounds of silage per head in the fall, and that amount shoud be cut down to at least 30 pounds by spring. I believe that a cow's system becomes saturated with the acid flavor of silage if fed for a long period of time, hence making it necessary to feed less.

The milk should be watched for garget, and if any is observed, the milk should never be used, as garget is an inflammation of the udder of the cow, and pus cells will pass with the milk, which is strictly prohibited by medical societies. Nothing will bring criticism from physicians quicker than milk that contains pus cells, bloody milk, or milk with deleterious bacteria.

The cows should be groomed in the afternoon, washed before milking, and the udder and flanks re-washed or gone over again with a damp cloth, to slightly dampen the udder to prevent dust from dropping into the milk pail. For one hour previous to milking nothing should be done to stir up a dust, as that is the worst thing to contend with. In the morning the cows should be brushed off with a cloth slightly dampened, and the udder prepared the same as in the evening. The stable should not be cleaned in the morning before milking, and no feed, bedding of any kind taken into or out of the barn. The floors should be sprinkled both morning and evening about 20 or 30 minutes before milking. The milkers should wear clean clothes, which are to be washed at least once a week, and only used during the time of milking, and kept in a clean place when not in use. All utensils should be sterilized, the hands washed before milking each cow, and the milk taken to the milk room immediately after milking each cow and put through the cooler, which is placed in the milk room joining the barn. This cooler should be completely enclosed and a pan like receptacle placed on top which should be provided with absorbent cotton discs, which are replaced for each milking with new ones after they are sterilized. With this method, if reasonably cold well water is used, no ice need be used until after the milk has been bottled.

HELP.

There is nothing so perplexing as the help problem, which is in the most aggravated form in a certified dairy where the work must be done scientifically. I believe no dairy can be so successfully operated as when in charge of the proprietor.

Certified milk should not sell for less than 10 cents nor more than 12 cents per quart. It can be produced and sold for that price at a small profit, if produced under the economical conditions mentioned, but where milk must be shipped the price should be from 12 to 15 cents.

The number of cows for a certified dairy should not be less than 30.

From what I have said you can see that the economical production of certified milk depends upon the location of the farm, the economical construction of the buildings, and economical operation of the plant as a whole, with good, intelligent, honest help.

In conclusion, I will say if any one has more money than they know what to do with, they can be relieved of a nice little sum if they wish to take the advice of some promoters of certified plants; however, it is not necessary to go to such useless expense, as certified milk can be produced at a reasonable expense.

THE FARM HOME.

(Dr. Edna D. Day, Professor of Home Economics, University of Missouri.)

Mr. Chairman, Ladies and Gentlemen—All this week you have been learning how to grow corn and feed cattle, how to raise pigs and make butter. From morning until night you have been learning how to produce to the best advantage. But why? Why do you care whether the crops are good or the pigs well fed or the butter well flavored? What difference do any of these things make to you if you and your family are not well fed, well housed and well clothed? If your home is not attractive and comfortable? If you and your wife have to work so hard that there is no time to enjoy life? If your children are not always well, good and happy?

But, perhaps, you say "It is because we care for these things that we have come here. We are studying how to make money in order that we may be able to provide the best things for our homes." Or, perhaps, you say "We are not so selfish as to think simply of ourselves and our families. We are Missourians, we have a pride in our State, and we are ambitious that Missouri pigs and cows be the very best in the world."

You certainly are as ambitious that Missouri men, women and children should be the best in the world. But perhaps it had not occurred to you that, after you have learned how to make money, some suggestions on how to spend it in order to get from it the best possible home for your growing children might be equally profitable.

A few years ago it did not occur to farmers that they did not know the best way to grow corn or feed cows. They felt insulted if anybody suggested to them that they needed to study the subject. But men who have been learning the value of balanced rations for cows may not be surprised to have it suggested that it might be well to see if their children are getting balanced rations. Possibly you say that the feeding of children is the work of women, and that if you had known anything was to be said on that subject, you would have brought your wife along. I am sorry you did not. She might have enjoyed the outing as well as you. Possibly in a year or two we shall have a Housekeepers' Conference Farmers' week that will make it seem worth while for her to come. But, in the meantime, I am glad to have an opportunity to speak to you men, and suggest some things that you can do for the home.

As I have been in different parts of the country, I have noticed that, on the average, men on farms are more interested in the details of their homes than are men in the cities. Certainly their pleasure and their recreation depend more on the home than that of men living in more settled communities; therefore, I feel sure of an interested audience. I have been in this State but four months. I have not yet had the privilege of going into a Missouri farm home. Therefore, if any suggestions I may make to you are not applicable in this State or to your particular home, you may sit back comfortably and congratulate yourself on your progress. What then do I suggest?

First, if you get so rich following the suggestions made in this conference that you decide to build a new house, be very careful in making the plans that you put more money into convenience than you do into size. Many a prosperous farmer, on rebuilding his home, has felt rich enough to make a house so large that his wife has not yet found time enough for its proper care. Not only are there more square feet of floor to be swept, but the steps necessary to do the ordinary routine work of the house have been multiplied many times. Perhaps in the old home the family ate in the kitchen. Now there is a dining room, and the dining table, the china closet, the pantry, the work table and the cook stove seem suddenly to have taken a dislike to each others' company. Perhaps the bed rooms used to be on the first floor; now they are upstairs, and because it occurred to no one when the plans were made that it would be much harder to heat a large house than a small one, they are cold in winter weather, and it is hard to persuade the children to stay in them long enough for proper bathing or tidy dressing. And the wife, who used to be bright and fresh of an evening to help the children with their lessons or to join them in a frolic, is now tired after her much walking back and forth and up and down. She has no energy left for her family, and certainly less for a party in the new parlor. She who should be the mistress of the house has become its slave. But do not think for a moment that I am discouraging separate dining rooms and upstairs bed rooms. I wish only to remind you of the cost of their maintenance and the necessity of providing for their care. It is very hard these days to get satisfactory hired help in the house, no matter how much one is able or willing to pay, and it is especially hard in the country. The help must generally be in the form of convenient arrangements, machines and labor-saving devices of various kinds. Put the largeness into verandas, for they need no furnace heat, are easily kept in order, and are a great comfort in the summer.

Perhaps the convenience most needed in the house is running water and drains. Some kind of power is necessary on most farms. If you have a windmill to draw up water for the stock, it will not cost much more to have it pumped into a reservoir at the top of the house and piped down into the kitchen. Some knowledge and skill is necessary in making drains to safely carry off the waste water from the house, but when you consider the wasted energy of the woman who has, with each dish pan of water, to walk across the kitchen floor, open the door, go down the steps and out across the land to find some place not wet from the last pan of water; when you think of the time wasted in this way, and think of the things the house-wife might have had time to do, if it were not for these numerous dishwater-throwing expeditions, I am sure you will decide the drain is worth its cost.

A recent farmers' bulletin (No. 270) on "Modern Conveniences for the Farm Home" gives directions for making drains. It gives suggestions also for many other conveniences in the home. It certainly is well worth the price of a postal card to the Secretary of Agriculture at Washington.

Since the men of the home generally have some responsibility for the stoves, I suppose I do not need to suggest to you that furnaces save labor. Perhaps I might add that with a good hot air furnace we may have a good system of ventilation in the house. Of course, you men are out in the fresh air a good share of the time, but the women and young children have to breathe the air of the house most of the time. For them, especially, some system of ventilation is necessary, and the good hot air furnace is a convenient form. Of course, it costs money, but fresh warm air in the winter time always costs money.

But to return to the subject of saving steps. The china closet ought to be somewhere between the dining room table and the kitchen sink. The kitchen work table ought to be near the stove and the sink, and it may well be a kitchen cabinet. If the food must be kept in the cellar in the summer time to keep it cool, a dumb waiter, with two or three shelves, run on pulleys between the cellar and the kitchen, is a servant well worthy of her wages. I wonder if you have ever stopped to count the number of times your wife makes the trip down and up the cellar stairs struggling with her skirt and a pan of milk, or with her skirt and a dish of butter, and a plate of meat, or, still, with the inevitable skirt and the vegetables or fruit. Are those stairs convenient stairs? Is there any chance that the skirt may catch on anything and cause a serious fall? Is there any danger of knocking her head? Are they light, so that they can easily be kept clean? With a dumb waiter, one trip to the cellar before a meal will be sufficient. If the vegetables are needed sometime before the cream and butter, the dumb waiter can be drawn up, the vegetables taken out and then the waiter let down again until the other things are needed. Sometimes all the food needed from the cellar in one day can be placed on the shelves in the morning and no other trip be necessary that day. Of course, an ice box on the ground floor would save all this effort. And a large ice box in the cellar would help very much with the fresh meat supply. As it is, most farmers have to depend on chickens for the greater part of their fresh meat, and unless one is in the poultry business, the care of chickens is another burden added to the household.

In cold weather there should be a pantry on the ground floor in which the food is kept, and this pantry should be within walking distance of the dining room and kitchen. If this is not possible, a box can be turned on its side and fastened just outside the kitchen window and the food kept in it.

If your house has been built without care to step-saving in the position of dining table, sinks and cupboards, a small table on rollers, especially if its capacity is increased by a lower shelf, will be found a great convenience. It can be used to advantage in setting and clearing the table. It is also helpful to have near the sink when the dishes are washed. They can be put on it and the table then moved to the china closet and emptied. Many a woman who is now tired of an evening would be fresh if she used a high stool at the sink and work table. And many a man would have better dinners if his kitchen floor was covered with linoleum instead of being of unfinished wood. It takes considerable energy on one's hands and knees with the scrubbing brush to extract the dirt from the pores of wood. It takes comparatively little energy with a mop to clean the smooth surface of linoleum, and there is plenty of strength left to prepare a good dinner.

You men have been looking at the milking machine. Probably each of you have a separator. If you find it an advantage to buy the latest machinery for the farm, you will also find it an advantage to buy a carpet sweeper, a washing machine, and a bread mixer for the home. Of course, your machinery is for the sake of making money, but you want to make money so you can have more comforts and conveniences in your home. Have the labor saving machinery in your home and your wife will be able to produce for you comforts and luxuries that money cannot buy. There are many little things such as egg beaters, palate knives, measuring cups, soap shakers, dish mops, sharp knives, and the like which are absent from some homes, partly, perhaps, because the wife does not like to ask for the money necessary for their purchase, and partly because not having studied physics or cultivated the mechanical side of her nature she fails to value until she has once used them. Until girls have studied something more of mechanics and manual training, we will have to depend on you men to see to it that the women have the mechanical help they need in the house and that they know how to use.

There is much talk about girls learning how to cook. They need to do that, but they need fully as much to learn how to use and value sharp tools and good labor saving devices, and I hope you will use all your influence to see that manual training and domestic science are introduced into the public schools, and to see to it that your wives, if possible, and certainly your daughters, have some time and means to supplement the knowledge gained in the valuable but expensive school of experience.

Lack of variety in foods is too common on busy farms. I have mentioned the fresh meat problem. Certainly in the country there should be no lack of vegetables, but the man of the family is so busy making money that he finds no time for a kitchen garden, and the wife is so busy in the house trying to get along without labor saving devices, that she had no time for the garden, and consequently the meals and health suffer. But while the means of transportation are no better than at present, the kitchen garden gives the only hope of varied diet. If only the men can do the first hard work in the garden and see that the indoor burdens are lightened most women will welcome the opportunity for work out of doors among the green things, and will be the better for it physically.

And one of the best kinds of education for the children is to give them each a small plot of land and encourage them to raise vegetables for the house table. Sometimes it is wise to let the children thus earn money for some of their clothes and learn in this way something of the value of money. But even if the garden is a nuisance, even if it does take time from other things, remember that no amount of money you can make will compensate for the lack of these fresh vegetables for your growing children. It is not simply comfort and convenience that is needed in the home, health is of prime importance.

According to the statistics of the United States Census Bureau for 1900, only 2.8 per cent. of the annual deaths in Missouri are due to old age. Just think, only 2.8 per cent of the people live to die of old age. Something is the matter. The larger part of our time is spent in the house. Is the home responsible? You may be perfectly well satisfied with the kind of homes your parents had, or the kind of homes you have. If none of your family have ever died of anything but old age, if none of them have ever been sick, I am not talking to you just now, but to your neighbor. Most diseases can be prevented in one of two ways—either (1) by keeping the body in first class condition, by following all hygeinic laws in regard to eating, sleeping, drinking, breathing, working and resting that disease germs cannot find entrance to the body. Or (2) by keeping the body from contact with disease germs.

Pneumonia and consumption cause more deaths in Missouri than any four other diseases. The present crusade against spitting is an attempt to prevent the spread of the bacteria causing pneumonia and consumption. But until the crusade has gained much more strength than at present, the home will need to be very careful of all hygienic and sanitary measures necessary to keep the body in good resisting condition.

Many a death, but much more sickness, is due to malaria. I wonder if you have ever calculated the amount of money that is wasted by the semi-sickness that allows one to drag around and do only half a man's work. We know that mosquitoes carry the disease germs of malaria. Sometimes it is possible to drain the land, and greatly reduce the number of mosquitoes. Certainly we can put screens in the houses. But above all, we should look after the general hygienic conditions of the body, that it may be able to resist the entrance of disease germs.

Typhoid fever is another too common disease. Its prevention in the country rests chiefly with the household. Care must be taken that no surface water gets into the wells and that flies do not carry to food germs from the fecal matter in which they breed.

Diarrhoea has the fourth place as the cause of deaths in Missouri, and here, again, it is chiefly the home that is responsible. Spoiled food, especially spoiled milk, is the common cause. The disease is more common in the southern part of the State than in the northern. Evidently it is due to food standing in too warm places. Is it not possible to have an ice supply?

From every standpoint we will all be thankful when the State has done something to use the limestone that it has in abundance, to make such good roads that communication with the market will be easy, not only to take produce to market but to get there the food, clothes, and tools that it takes too much labor to produce at home. And good roads mean more than material blessings. They mean better education, more regular church attendance, more social life.

The isolated home needs not only to use special care to make its numerous duties easily done, and to be most careful of all health conditions, because the doctor is far off; but it has also, especial problems in educative recreation. There are any number of games that are possible in the farm home, no matter how isolated, but there are fewer friends to suggest them. Books are hard to get. I understand that Missouri is still without traveling libraries. Each home must be well supplied with its own choice literature. Art galleries are not near, but it is possible to get very good cheap copies of the best masterpieces of art. The Perry pictures at one cent apiece are a great means of education. After the family have collected a large number of these and studied them for some time, it is able to intelligently decide what two or three large pictures it wants for the walls. Concerts are hard to reach. Good music teachers are at a distance. But the farm home, as well as the city home, can have a Cecilian or some other of the modern piano players. In this way the family may hear a concert of the best music at any time. It is a splendid means of education and certainly a most restful means of recreation when one is tired of an evening.

Is all your money spent? Have you spent it before your chickens are hatched or your cows grown? I hope you have properly proportioned it, so that all the sanitary conditions of your home are satisfactory, that you have a variety in your foods, that you have every possible labor-saving device, that you have a good library, that on your walls hang masterpieces of art, and that your soul is being elevated by listening to the best of music.

SILO EXPERIENCE IN MISSOURI.

(R. M. Washburn.)

The silo was once a failure because not properly built; it is now a success because experience has taught what points are necessary. When it comes to changes in farm methods, the farmers of Missouri know a good thing when they see it. If there are any in Missouri who now doubt the worth of a silo for stock feeding and are willing to learn from those who have had experience, let them read the words of the following gentlemen who have learned by experience.

Mr. Jesse Williams, Excelsior Springs, Clay county, Mo., has used a silo two seasons. He feeds silage to milk cows, horses, calves, hogs and chickens and says, "Last year I fed from 35 to 60 head of cattle out of the silo from October 7 to August 15. When the silage ran out it took 400 pounds of bran per day to take its place."

Mr. Thomas Shields, Eureka, St. Louis county, Mo., has used a silo two years, fills it with corn, sorghum and cowpeas, feeds to dairy cows and heifers and says, "As to cost of filling, my farm is not sufficiently large to pasture my herd and raise sufficient feed to fill silos, so I have to depend on renting land anywhere I can get it. Some of the corn was hauled three and one half miles this last season. While I could not give the practical cost, I will say I was well paid for the hauling. My silo was filled as follows: Three feet corn then four feet cowpeas, then eight sorghum and finished filling with corn. My dairy herd gave best results with corn. I had intended filling one load of each but fields were so far apart and labor so scarce I could not do so."

Mr. J. E. Roberts, Bolckow, Andrew county, Mo., has used a stave silo one year, filled it with corn, fed to dairy cows with "excellent" results. He says, "I think a silo is a necessity to any Missouri farmer who has stock. I am satisfied the increase of production of milk and cream has paid for my silo this year. My cows have milked the past winter just like they were on grass."

Mr. Robert E. Mitchell, Woodlandville, Boone county, Mo., built a concrete silo a year ago, filled with corn, feeds to cows, steers, and young cattle and says, "This is my first year's experience with a silo and, farmer fashion, I have not kept a close account of everything either, as to the cost of building, filling or feed contained, but feel that by approximating, I can safely say that it has saved me somewhere from 25 to 50 per cent on my feed bill (probable one-third this past winter, and the physical effect on the cattle would be very hard to estimate, but it has been *very* satisfactory. I think anyone wintering as many as 20 or 25 cattle, either milk cows or steers, would be compensated for building a silo."

Mr. E. L. Ensign, Cameron, Clinton county, Mo., has used a stave silo one year, fllled with corn and sorghum, fed to cows with "fine" results. He says, "It has saved me money. This being my first year, I cannot tell as well as I can after a little more experience with the silo. The corn was pretty ripe before I got my silo ready. I put every sixth load, a load of cane and thought my silage had enough moisture, but believe it would have kept better if I had put several barrels of water in it."

Mr. Philander P. Lewis, Cresent, St. Louis county, Mo., has used a stave silo two years, fills with corn, feeds to dairy cows and young cattle and says, "Silage is the cheapest dairy feed we have. It increases the milk and improves the conditions of the cows. I would not try to run a dairy without it." He adds, "I have found that silage is not only a cheap and splendid feed for cows but that horses, hogs and chickens do better from having it. I believe that every farmer who is feeding cows, horses, hogs, etc., would find the silo a profitable investment."

Mr. George Bothwell, Nettleton, Caldwell county, Mo., has used a stave silo one season. Fills it with corn and soja beans, feeds it to dairy cows with the "very best results." He adds, "My cows ate the silage with a relish, gave a heavy flow of milk all winter, and came through the winter with a soft coat of hair and mellow hide. in that respect they had the appearance of cattle in perfect show bloom. Of course, in addition, we fed some grain and other roughness."

Mr. Wm. H. Bruns, Concordia, Lafayette county, Mo., has a stave silo, used five years. He fills his silo with "corn and cowpeas grown together, planted together, drilled all at one time." He says, "Corn and cowpeas make a silage that the cows like better than anything else I ever fed to them." Just think of how much more feed the corn crop will make, if the whole crop is eaten by the stock, stalks and all."

Mr. Wm. Plummer, Hale, Carroll county, Mo., feeds silage to dairy cows and calves and says "Our cows milk fine all winter and come out in good order in the spring. I couldn't get along without my silo now."

Mr. W. Guy Ensign, Cameron, Clinton county, Mo., has used a silo one winter, filled it with corn, fed to milk cows and calves. He says, "Our cows milk on silage about the same as on grass. Calves grow fine on it," and adds, "We started in last winter with more stock than we had carried through for some time, and on account of the dry weather we had less feed than usually, and we have got feed (hay and roughage) to carry over. Ensilage seems to be a very healthy food. For instance, we had a horse that always stayed poor and not in good spirits till we started to feed him silage, and from that time he began to pick up. I think for a man who owns a farm and keeps either milk cows or who is growing young stock, cannot afford to get along without one. It seems to keep cattle healthy."

Mr. E. V. Mahaffy, Pleasant Hill, Cass county, Mo., has used a silo more than two years, fills with corn, cowpeas, sorghum and alfalfa, feeds to milk cows and hogs with "good" results. In answer to the question, "Does the money come to you enough faster with the silo to pay for the trouble?" He answers, "Yes," and adds, "A great many make the mistake of letting the corn get too ripe. I think the best time is to cut the corn when it is just too hard for roasting ears. If you put good silage in the silo, and pack it well, it will come out good, as the silo makes it no better. It just keeps the feed. This is the only economical way of feeding. We feed silage the year around with good results."

Mr. Henry Logan, Sedalia, Pettis county, Mo., has used a silo eight years, fills with corn, feeds to "cattle, cows, hogs, calves and horses" with "good" results and adds, "I would not be without the silo under any consideration. I cut my corn in September when the weather is good, and in about five days I have 250 tons of feed in the silo. That runs me for 12 months. I feed my cows the year around. There is nothing on the farm that pays better than the silo."

Mr. H. M. Packard, Kenoma, Barton county, Mo., has used a silo eight years, fills with "corn fodder with a little shredded cane on top. That way it will keep very near perfect to the top." Feeds to dairy cows with "good" results and adds, "I think it is the cheapest feed I can get. I would not be without the silo. I thought one year I could get along without, but found that I could not. Built a concrete."

Mr. H. C. Goodrich, Calhoun, Henry county, Mo., says "No dairyman can afford to be without a silo. I consider it the best and cheapest way to save the whole corn crop. I have fed ensilage to dairy cows for 12 or 13 years."

Mr. Joseph Elliott, Windsor, Henry county, Mo., feeds silage to cows and young stock and says "I like the silage for feeding very well. Would not like to be without one. It is not only good feed for cows but all kinds of cattle, and when it is put up in the fall it is so much easier to get at than to have to go to the fields for corn fodder; with ensilage we get the whole corn plant for food."

Mr. Fred Parcher, Maryville, Nodaway county, Mo., feeds silage to cows and young cattle and says, "Results in a saving of one-half in feed store bills and over one-half in amount of hay eaten."

Mr. H. S. Hand, Appleton City, St. Clair county, Mo., says "I find it (silage) excellent for dairy cows. Our cows milk as well in winter as they do in summer; in fact, they usually gain when we commence to feed."

Mr. John Miles, Grays' Summit, Franklin county, Mo., feeds silage to dairy cows and horses and says, "Results are good. I like it well and think it an ideal method of securing succulent food."

Mr. Fritz Sensor, Corder, Lafayette county, Mo., says, "I have been feeding it to all of my cattle. It is of most value to milk cows."

Mr. John Patterson, Kirksville, Adair county, Mo., has fed silage for many years and says of it, "When I speak of the economy of putting corn into silos to feed cows, I don't mean that it is good for cows only, it is good for all kinds of stock. All seem to like it and thrive on it, and when you get buildings and machinery for it, it does not cost any more to put it in silos than to cut and shock, etc., and it is much more convenient to feed in barns or sheds where stock can be comfortable and all the manure saved."

Mr. N. H. Gentry, Sedalia, Mo., says, "I put up a silo the past summer 30 feet high by 20 in diameter. We filled it with cut corn and it is proving a very cheap, economical feed. We are feeding it to all our cattle, and our work horses have had no other grain all winter, keeping in good condition. In thus consuming the whole corn plant it proves a very cheap food. We mix a little other grain with it in feeding milk cows and young cattle we wish to push along, but the dairy cows get nothing but it, and they eat very little hay. I think I will put up a smaller silo for summer feeding in case of severe drouth, and after carrying it through the summer and it is not needed, we can feed it out through the winter or fall."

Mr. C. T. Graves, Maitland, Mo., had charge of the Jerseys at the World's Fair in 1904, and the excellent showing made there was partly due to the superior corn silage that was fed.

Redmond & Hurst, Tipton, Moniteau county, Mo., use two "bin" silos and says, "We are milking 50 cows in all stages of lactation, 10 of which are heifers with first calf, and our check for January cream was $265.00; not so bad for winter."

Mr. McNish of Brookfield, Mo., has two silos. He says, "I feed all classes of cattle with good results, especially for growing stock. I fed a car load of steers silage and ear corn and topped the market. The only difficulty in feeding silage with ear corn is that the cattle which are to be fattened will quit eating ear corn and eat silage alone. Corn, I believe, should be ground when feeding with silage for fattening steers."

The writer has personal letters in his possession from all of the above named men to prove that they said just what is accredited to them. Either the silo is a mighty good thing, or else it has a way of fooling a lot of mighty good men. About 100 were built in Missouri last year.

RESOLUTIONS ADOPTED BY THE STATE DAIRY ASSOCIATION.

We, the State Dairy Association of Missouri, assembled in seventeenth annual convention, and representing 25,000 dairy farmers in Missouri, hereby resolve:

First: We thank the Columbia Commercial Club for their liberal financial assistance.

Second: We wish to express our obligations to the State Board of Agriculture for their financial assistance, and to the Honorable George B. Ellis, Secretary, for his efficient efforts in behalf of our meeting.

Third: We appreciate the attendance of the representatives of the various machine companies with their exhibits, and wish especially to thank Blanke & Hauk, and A. H. Barber Companies for their unusually extensive exhibits.

Fourth: We favor the holding of a National Dairy Show in Chicago next fall.

Fifth: The thanks of the Association are extended to Professor Oscar Erf of the Kansas Agriculture College through whose courtesy was made possible the exhibit of the milking machine, and we also extend our thanks to Mr. S. Suzuki for his services in operating the same.

Sixth: We favor the establishment of reasonable pure food regulations and higher standards of purity for dairy products.

Seventh: We appreciate the effective work of the present Dairy Commissioner, R. M. Washburn, and ask that he be re-appointed, and the same appropriation be made by the General Assembly as before to carry on this important work.

Eighth: We recognize the great importance of the Agricultural College of the University to our interests and appreciate the immense value of its past services. We further recognize that this work must now be expended to meet the rapidly growing argicultural and dairy interests of the State and the increasing demands made upon the College, and therefore ask that the General Assembly grant the very reasonable request made by the Board of Curaotrs for appropriation for the next biennial period.

Ninth: We ask the General Assembly to pass a law enlarging the scope and the power of the State Veterinary Department for the purpose of the better control and stamping out tuberculosis now found in some of the herds of cattle in our State.

Tenth: For the third time we call the attention of the Board of Curators, and through them, the General Assembly, to the urgent need of a new dairy barn on the College ground. The present structure is a disgrace to the dairy interests of the State and to the dairy herd now owned by the University.

D. A. CHAPMAN, Warrensburg, Mo.
WM. A. H. OETTING, Concordia, Mo.
B. O. TERRY, Greencastle, Mo.
Committee.

The nominating committee consisting of F. L. Austin, St. Joseph; A. Bergman, Concordia, and J, B. Berghaus, Billings, reported that it was their opinion that the officers of the last year should continue throughout another term. Mr. Chapman of Warrensburg took the chair and put the motion, thus electing the following to office: President, Dr. Geo. C. Mosher, Kansas City; First Vice-President, J. M. Smith, Brookfield; Second Vice-President, Thomas Shields, Eureka; Secretary, R. M. Washburn, Columbia; Treasurer, D. B. Matthews, Kirksville.

SESSION

Improved Live Stock Breeders' Association.

January 8-9, 1907.

LIMITATIONS OF BABY BEEF PRODUCTION.

(H. J. Waters, Dean of the College of Agriculture, Columbia, Mo.)

Two quite independent classes of cattlemen are vitally interested in the subject of baby beef. One is the breeder and raiser of cattle; the other the man who fattens them or fits them for market. In other words, the cattle breeder on the one hand, and the professional feeder on the other.

It is from the view point of the professional feeder alone that this subject is on this occasion presented. To discuss it from the standpoint of both parties would be quite beyond the scope of a single address. To deal with this subject from the view point of the cattle raiser is reserved for a future discussion.

For many years the teachers and writers on agricultural topics have been strong advocates of baby beef. The professional feeder, whose livelihood depends upon his success in this business, has continued to show a decided preference for older cattle. The teachers and writers have based their opinions on the results of experiments that have been somewhat numerous and extensive, and, at first glance, unimpeachable. The feeder has based his judgment upon extensive experience covering many years and with large numbers of cattle.

It is scarcely to be supposed that both parties to this contention are right. Nor is it to be taken for granted that the man whose position is sustained by practical experience alone is necessarily the one who is wrong.

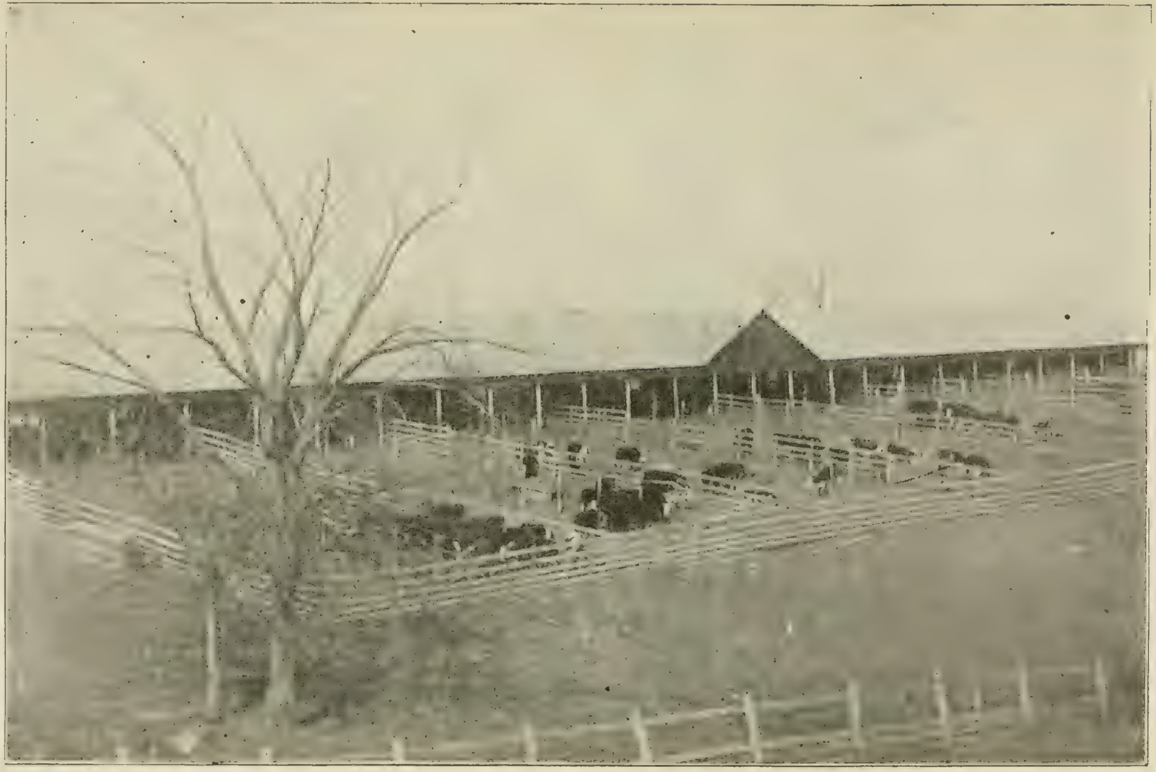


Fig. 1. Experimental feeding sheds and lots at the Experiment Station, where an elaborate study of the best methods of wintering cattle are being conducted in co-operation with the U. S. Department of Agriculture.

During the past eleven years the Missouri station has conducted a great many feeding trials, and has taken great pains in the meantime to secure the results of the experience of thousands of the most successful feeders, and when submitting their practice or conclusions to the most rigid experimental tests, we have found that in a large majority of cases they had reached the correct conclusions and that their practices were well founded.

WHAT IS BABY BEEF?

Baby beef is now quite another thing from what it was fifteen or twenty years ago. Then a 30-months old steer weighing 1,400 pounds would have been classed as strictly baby beef, and he would certainly have looked the part of a baby by the side of the three or four or five-year-old bullocks, weighing from 1,800 to 2,200 pounds, thick, fat and hard.

Our point of view has changed radically. These huge bullocks are no longer on the market, and if some one should be so misguided as to make them now, there would be no one at the market to welcome or to buy. The demands of the market have changed.

We have been gradually hastening our cattle to the market, cutting down their ages and their weights, until a twelve months old calf weighing 800 or 900 pounds will bring as high a price as any other age or weight, provided he be fat. So size or weight does not any longer constitute a limitation to baby beef production.

According to our present understanding of baby beef, no steer would be so classed outside of his yearling form, and as a rule the maximum age would be from 18 to 20 months, and the maximum weight from 1,100 to 1,300 pounds. This means that the feeding operation begins with the calf at weaning time, approximately at six months old, weighing 450 to 500 pounds, and continues without interruption until the animal is fat. Some even go farther, and begin the feeding period as soon as the calf is old enough to eat and while it is still running with its dam, and place these animals on the market the following June or July at 14 or 15 months of age, and weighing from 800 to 1,100 pounds.

THE PROFESSIONAL FEEDER'S PRACTICE.

Some years ago the writer sent a circular to about 3,000 of the leading feeders of Missouri, Iowa and Illinois, interviewing them regarding certain phases of their practice in beef production. Three of the questions submitted were intimately connected with the question of baby beef production, or dealt with the length of time the cattle were fed, weight at the time they were marketed, and the age at which they were put on full feed. Something like 1,000 answers were received from the most experienced and successful cattle feeders of the corn belt—men whose average experience in feeding cattle was something like twenty years per man, and who had fed and marketed an average of about 2,000 cattle each, or an aggregate of something like two million cattle. A very brief summary of their replies to the questions bearing upon the subject under discussion will be exceedingly interesting at this point.

One of the questions asked was:

"What is the average length of your feeding period, i. e., the number of days your cattle are on full feed?"

The individual reports varied all the way from 60 or 90 days for a short feed on old cattle, to a full year for baby beef. The average of all the answers received to this question is as follows:

State	Number of reports.	Average length of feeding period. Days.
Missouri	684	174
Iowa	86	180
Illinois	35	190
Nebraska	1	200
Average	806	177

The close agreement in the average length of the feeding period between the various states, barring Nebraska, from which we had but one report, and, in fact, the close agreement between the individual reports on this point, is very significant. It is particularly interesting, when the answers to this question are considered in connection with the answers to the question concerning the weight of cattle that have returned the greatest profit, and to the question in relation to the age at which they put their cattle on feed.

Clearly, the length of feed is most intimately related to the age of the cattle fed, and is likewise closely related to the quality of the cattle. It goes without saying that these men, in answering the question as to the average length of their feeding period,

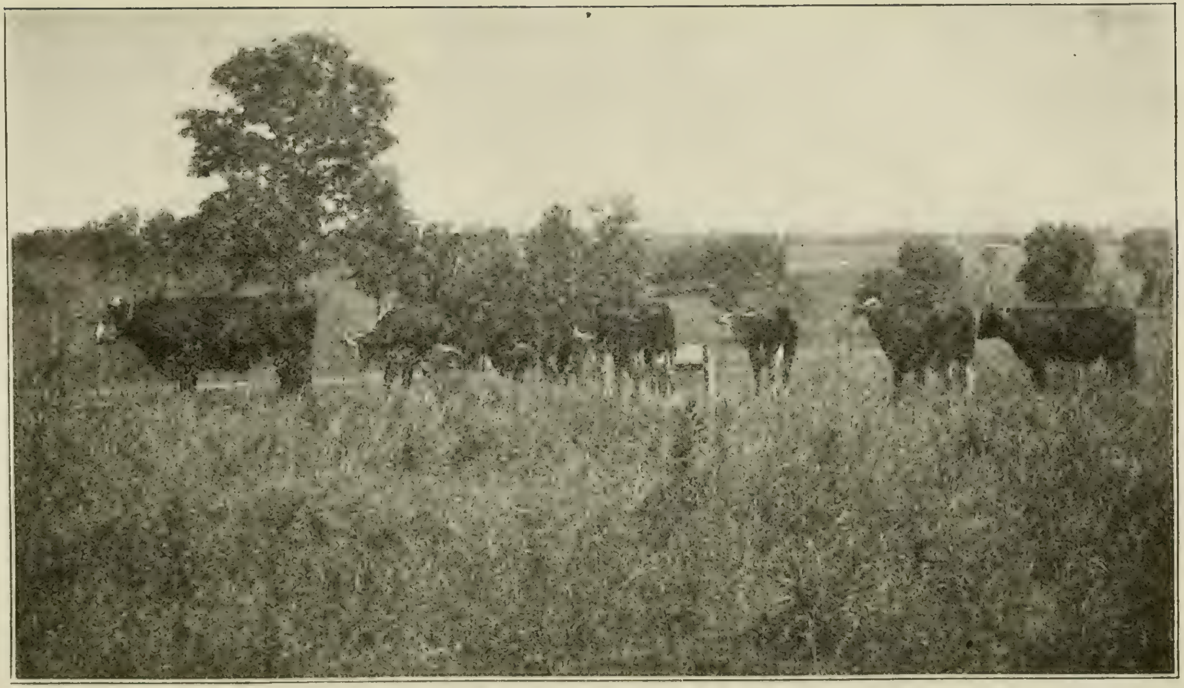


FIG. 2. Pastures at the Agricultural College, where the summer feeding experiments have been conducted.

had in mind the making of good cattle into prime beef. It is furthermore clear from their answers to this question alone, and still further by their answers to questions 8 and 13, that they also had in mind cattle of from 24 to 32 months of age.

A LONG TIME IS REQUIRED TO MAKE YOUNG ANIMALS FAT.

The younger the animal the longer the time required to make it fat. This is on account of the tendency of the young animal to utilize its feed so largely for growth instead of for fat. It is fat that makes the animal ripe and marketable.

Clearly, the young animal, when on full feed, puts its food to three distinct uses: 1, maintenance; 2, growth; 3, fat. The rate of growth diminishes as the age of the animal increases. After a certain time, therefore, the animal would reach an age when growth would cease entirely. At such a time in the life of any animal all of the available food above maintenance would necessarily go to the production of fat. The presumption is that the requirement for growth diminishes, not directly with the age of the animal, but rapidly from weaning time to 18 or 20 months of age. By this time the tendency to grow in the average well-bred and early maturing steer has so far diminished as to not affect the fattening process very seriously. It goes without saying that with the decline in the tendency to grow comes a corresponding increase in the tendency to fatten. These are all matters of common observation among feeders, particularly the ease with which older cattle may be made fat, and the comparatively short feeding period necessary to bring this about, and, on the other hand, the great difficulty in making young animals fat and the long time required to accomplish it.

Starting with six-months-old calves in good flesh, twelve months time is required for making them strictly prime. Whereas, three-year-old or four-year-old steers, of similar quality and thinner in flesh to start with, may be made prime in six months. Or, the same principle may be illustrated in another way: To make a six-months-old calf prime will require the laying on of from 600 to 700 pounds of additional weight, making the finished animal weigh from 1,150 to 1,300 pounds, and requiring, as has been said before, some twelve months of full feeding. Whereas, a three-year-old steer, even thin in flesh at the outset, may be made strictly prime by the addition of 400 pounds, weighing at the close of the feeding period between 1,550 and 1,650 pounds.

RELATION OF LENGTH OF FEEDING PERIOD TO THE QUALITY OF THE CATTLE.

It is only cattle of good quality that can be profitably made prime. Cattle of inferior grade bring too low a price when finished to justify the expense of making them thick. This arises from the fact that the condition of the animal affects in a profound way the cost of gain, and the fatter the animal the slower the gains and the more expensive they become. Necessarily, therefore, the thinner the animal the more rapid and cheap will be the gains. Thus, beginning with a thin steer, other things being equal, the cost increases as the feeding period advances. It does not increase, however, at a uniform rate. The conditions of the weather and the character of the feed remaining unchanged, there is an enormous difference in the cost of the last 100 pounds put up on a steer if it is made fat enough to top the market, as compared with the advance occurring in the earlier parts of the feeding period.

It is obvious, therefore, that these costly gains at the end would not be justified on a steer that would sell at four and one-half cents a pound, whereas they might be fully justified in a steer that could be made to sell when fully fat for six and one-half cents. The cost per pound of the gain made in the latter end of the feeding period is out of all proportion to the price it will in itself bring when the steer is sold. This additional fat, however, so increases the value of the whole carcass of the steer as to justify the practice and return a profit by making him prime, provided he is good enough.

In this connection it will be interesting to note the answers to questions 8, 9 and 13:

"About what weight at selling time has in your experience returned the most clear profit, and why?"

A study of the detailed answers to this question will be exceedingly profitable, and the summaries by different states and even by different counties in the State are very signifiicant. Note the unanimity with which these answers fall between 1,200 and 1,400 pounds live weight. Occasionally one drops to 1,100 to 1,400 pounds, which means that in the judgment of this particular feeder yearlings have been more profitable than older cattle, and occasionally there will be a feeder who still feels that he has made more money out of 1,500 or 1,600-pound steers, which means three-year-olds, than out of lighter weights.

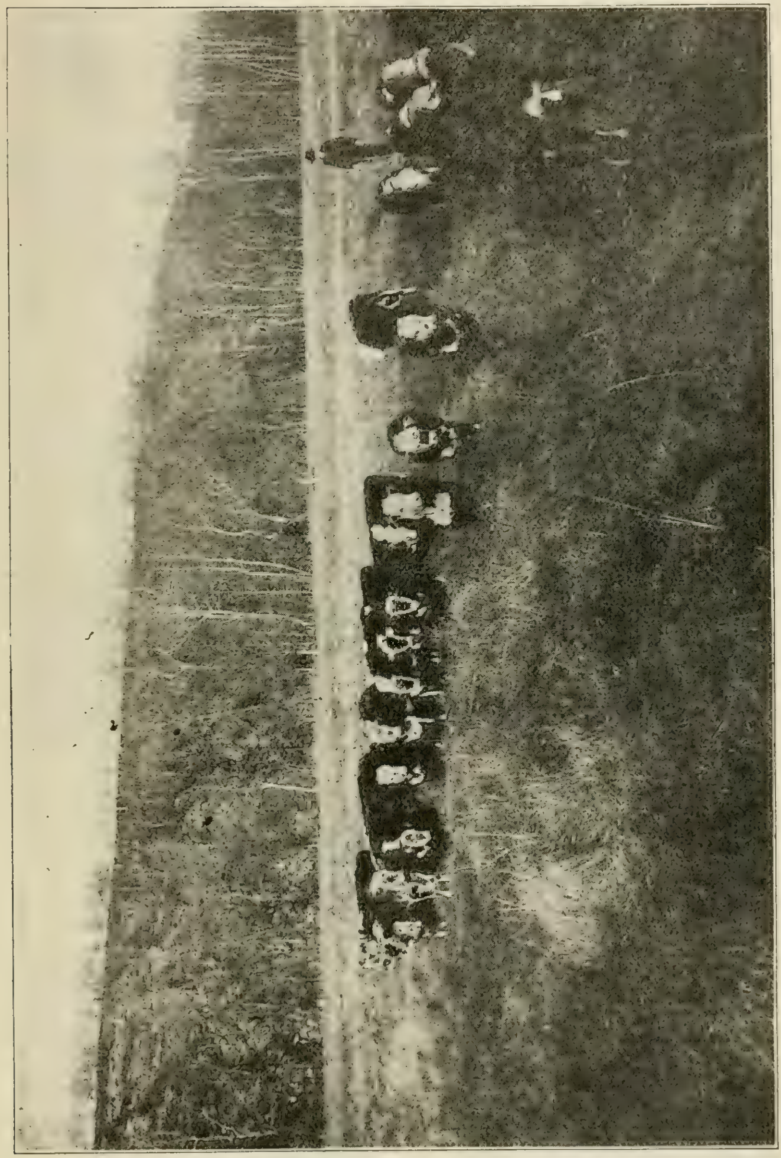


FIG. 3. A part of the first lot of baby beef made in the Missouri experiments.

The summary, by states, is as follows:

State	Number of reports	Most profitable weight.
Missouri	623	1345
Iowa	80	1358
Illinois	33	1390
Nebraska	1	1400
Total	727	1367

This means that these feeders have found the so-called "dressed beef" steer weighing from 1,200 to 1,400 pounds on the market the most profitable class to produce. This is primarily because of the steady and uniform demand for cattle of this class on the market, rather than because this particular age or weight of cattle were produced more cheaply than lighter and younger ones. For a full discussion of the relation of the selling qualities of the different ages and weights the reader is referred to a bulletin of the Missouri Experiment Station on Beef Production, number 76.

There has been during the past twenty-five or thirty years a marked change in the market demands of cattle. Formerly, added to the difficulties of making young cattle fat that have already been pointed out, was the further disadvantage that light weights would not bring as good a price as heavier weights. Before discussing the bearing of these figures upon the whole problem of profitable beef production, it will be well to consider the answers to the next question and likewise the answers to the ones that are intimately related.

"Have you found it profitable under ordinary circumstances to produce 1,500 to 1,600-pound steers?"

The summary of answers, by states, is as follows:

State	Number of reports.	Yes	No
Missouri	614	196	418
Iowa	73	19	54
Illinois	34	13	21
Total	721	228	493

PERCENTAGES.

State	Number of reports.	Yes	No
Missouri	614	31.92	68.08
Iowa	73	26.03	73.97
Illinois	34	38.23	61.77
Average	721	31.61	68.39

We shall also introduce the evidence in regard to the age of cattle preferred, as the weight, age and length of feeding period are all intimately related. In answer, therefore, to the question: "At what age do you usually put your steers on full grain feed?"

We have the following interesting summary:

AGE AT WHICH PRACTICAL FEEDERS PUT THEIR CATTLE ON FULL FEED.

State.	Number reports.	Calves.	1-year-olds.	1½-year-olds.	2-year-olds.	2½-year-olds.	2 to 3-year-olds.	3-year-olds.	3 to 4-year-olds.	All ages.
Missouri	680	25	22	29	257	91	77	149	16	14
Iowa	88	1	4	8	36	15	15	9	....	....
Illinois	38	3	3	2	14	8	4	4	....	....
Total	806	29	29	39	307	114	96	162	16	14
Percentages.										
Missouri	680	3.68	3.22	4.26	37.80	13.38	11.32	21.91	2.35	2.06
Iowa	88	1.14	4.54	9.09	40.90	17.05	17.05	10.23	....	....
Illinois	38	7.90	7.90	5.26	36.84	21.05	10.52	10.52	....	....
Average	806	3.60	3.60	4.84	38.09	14.14	11.91	20.09	1.98	1.74

FEEDERS PREFER CATTLE IN THE TWO-YEAR OLD FORM.

As has already been pointed out, it is quite evident that the feeders, in filling out our blanks, had in mind cattle in their two-year-old form. This is evidenced by their stating that the average length of the feeding period was six months, which is about the time required to make two-year-old cattle prime, is longer than is necessary for three-year-olds, and is too short for yearlings or calves. It is further evidenced by the average weight which they considered they had found most profitable, viz., approximately 1,350 pounds. This is too light for three-year-olds, and too heavy for yearlings or calves.

Then, again, the question put to them directly as to whether they had found 1,500 or 1,600-pound steers profitable, as a rule, out of 721 replies, in round numbers, or practically 70 per cent, answered in the negative.

All of this is further confirmed by the answer to the question direct as to what age they usually put their cattle on full feed. A study of this age summary is exceedingly interesting and instructive, as the results are very striking. For example, out of a total of 680 replies from Missouri, 257, or nearly 40 per cent, gave two years as the age at which their cattle were put on full feed, which would mean, with a six months' feeding period, as was reported by them in answer to previous question, 30 months old cattle, when finished and ready for the market.

Thirteen per cent gave two and one-half years of age, and 11 per cent gave essentially the same answer, namely, "between two and three years of age," as their preference. Thus more than 62 per cent of the Missouri feeders reported that they put their cattle on feed at between two and three years of age, as contrasted with less than 4 per cent who put them on as calves, less than 4 per cent who put them on as yearlings, and but a fraction over 4 per cent who put them on at one and one-half years of age.

What is true of the reports from Missouri is essentially true of Iowa, as will be readily seen from the summary just presented.

It is a significant fact that in Missouri, Iowa and Illinois the number of men who put their catte on feed at three years of age was almost double the number who put their cattle on feed under two years of age.

It is evident, therefore, that after all that has been said about the advantage of cheaper gains made by young cattle, the cattle

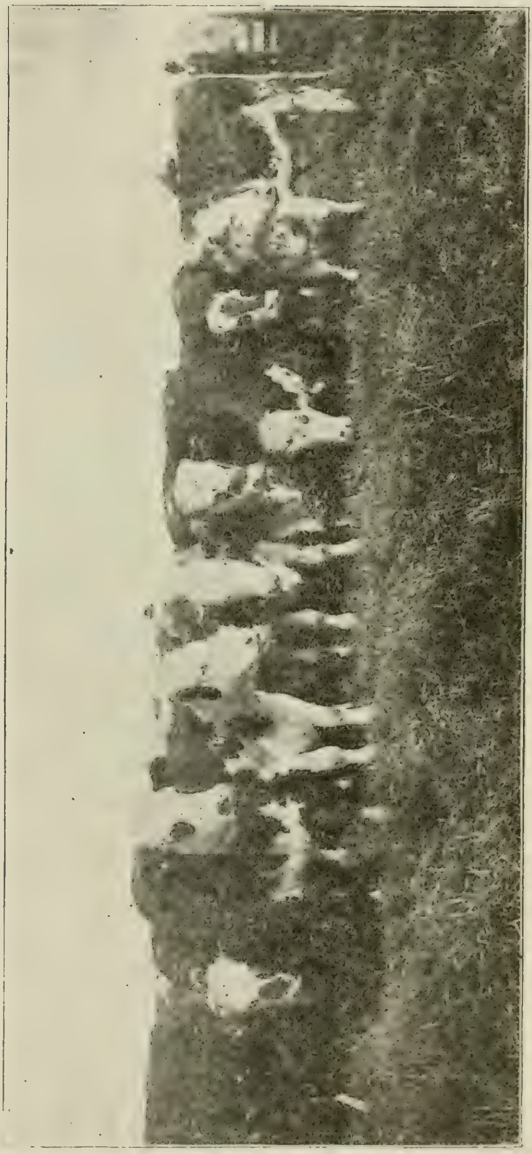


FIG. 4.—Three-year-olds, ready to top the market.

feeders of the corn belt are not yet making baby beef. There are three important reasons why this is so to be briefly considered in this connection.

First, the cattle feeder is, as a rule, not a cattle raiser. At any rate, he raises only a small portion of the cattle he feeds. The cattle raiser, on the other hand, is, as a rule, not a cattle feeder, seldom even feeding those of his own raising. The raising of cattle and the fitting of them for market are two separate and independent operations, conducted, as a rule, by two different men, each operating independently of the other, and the one not especially interested in the scope or outcome of the other's operations. The cattle feeder is interested in the cattle raiser only to the extent of having him supply him with animals of the proper quality and at such price as will enable him to fit them for market with profit.

Under the conditions of the feeder and stocker market that have prevailed in recent years, at least, the younger animal in an unfinished condition sells for enough more per pound to fully counterbalance any advantage it may possess in the cost required to make it fat. Or, to state it differently, the older animals may be bought for enough less per pound to overcome the excess cost required to finish them for market. Or, in feeders' parlance, the margin of profit in older cattle is greater than in younger animals. This may be illustrated by statistics furnished the writer by a number of experienced feeders in Central Missouri, whom he has interviewed recently on this point.

RELATION OF AGE TO THE COST OF FEEDERS.

Taking calves of a quality that in the fall, say October 1st, would be worth 5 cents a pound, weighing from 350 to 500 pounds, cattle of the different ages could be bought for about the following prices, one year with another:

Yearlings, $3.75 per hundred.

Two-year-olds, $4.00 per hundred.

Three-year-olds, $4.25 per hundred.

These same cattle next spring would stand the feeder, in the judgment of these men, on the basis of the same market as in the fall, as follows:

Yearlings (which are the calves referred to in the above table), $5.00 per hundred.

Two-year-olds, $4.50 per hundred.

Three-year-olds, from $4.75 to $5.00 per hundred.

It is likely that these figures represent extreme differences, but if they are even approximately correct, it shows an enormous spread between the cost per pound of yearling, two-year-old, and a material difference of three-year-old cattle, in comparison with that of calves in the fall, and between yearlings on the one hand and two and three-year-olds in the spring. The difference between two-year-olds and three-year-olds, as given in the above summary, if correctly representing the market, would seem to the writer, in the light of our feeding experiments, irrational, but the reader is referred to our bulletin on baby beef production, where this matter is discussed in detail.

Secondly, they can make the older cattle fat in less time with more certainty, and they will fatten up more evenly and with less attention to the niceties of feeding.

Third, the older cattle, when not fully finished, will come nearer selling for what they are worth than will young animals.

Fourth, two of the cardinal principles of baby beef production are that the animals must be choice in quality, and they must be prime. This of very necessity eliminates a great majority of the cattle from the possibility of being made into baby beef.

After all, the whole question of baby beef interests the breeder and raiser of cattle rather than the feeder, as these operations are now divided. This means that the raiser of cattle on high-priced land in the corn belt is the one who will lose whatever is lost on the three-year-old steer, or even on the two-year-old steer, or whatever is lost in the entire operation by the failure to fatten and market him early. The professional feeder may be expected to continue to prefer to feed cattle that have passed the period of rapid growth, and have gotten to a point where they will take on fat easily, rapidly and uniformly, so long as the breeder and raiser will consent to grow them to this age for him, and sell them to him with a sufficient margin, so that the feeding operation will prove profitable.

If the raiser and the feeder of cattle were the same man, it would be but a short time until our cattle would be going to market at from 14 to 18 months of age, instead of from 30 to 36 months of age, under the conditions now prevailing in the corn belt. Already there has been a marked tendency on the part of the farmer on the high-priced land in the corn belt to go out of the business of raising beef cattle. This has been particularly true under the influence of the high prices for corn that have prevailed in recent years, and a steady advance in the price of land and labor. This is very strikingly true of the best corn regions of Illinois, Missouri and Iowa, and has forced the feeder to rely more and more upon western or range cattle, which, in the meantime, have been greatly improved in quality, so that a two-year-old range steer now is as large and almost as mature in form as was the three or four-year-old steer of twenty years ago from the same region. In the meantime, however, land values have advanced enormously in the range country, and the ranchman is beginning to insist upon selling his cattle younger and thus reduce expenses in making them.

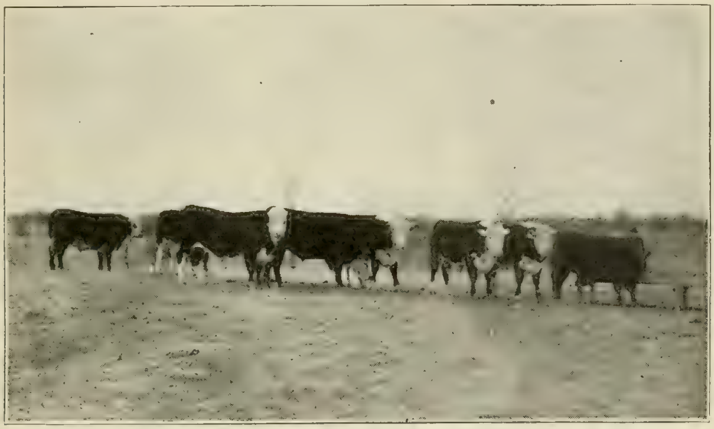


FIG. 5. Three-year-olds about finished.

It may, therefore, be accepted as final that so long as the cattle raiser, whether he be on high-priced land in the corn belt or on the ranches of the west, will supply cattle of moderate maturity, such as two-year-olds, to the feeder at enough less per pound than he will sell calves or yearlings to enable him to meet the increased cost of gain required to make them fat, so long will the feeder continue to feed this class of cattle in preference to younger ones.

GAINS MADE ON YOUNG ANIMALS ARE CHEAPER.

The baby beef advocate has had for his chief argument the fact that young animals make cheaper gains than do older ones, or that the cost of a pound of gain increases as the age of the animal increases. This law is well established. This is primarily due to the fact that growth, or lean meat, requires less food for its production than does fat, for lean meat is a watery tissue compared with fat, and is not nearly so concentrated a product. In fact, fat is the most completely dried out and most concentrated animal product we have.

In the whole realm of animals, when one is required by nature to store up energy in a compact and concentrated form, either for making long journeys without food, as is the case with the dromedary; to subsist a long time without food in winter, as is the case with the bear and other wild animals; or the fortifying of the mother with young at side against the lack of food for the production of milk by the drying up of the ranges, and so forth, and so on, the form in which this energy is stored is always fat. This is true the world over with all classes of animals, both wild and domestic.

The younger the animal, the larger the proportion of its gain in weight, is growth, and the smaller the proportion that is fat. There is nothing, so far as we know, to indicate that a young animal can manufacture fat from feed and store it up at any less expense than an older animal. A pound of fat contains a definite number of units of energy, and requires perhaps the same quantity of feed to produce it in one animal as in another of the same species and in the same condition. It is self-evident, therefore, that the greater the proportion of the total gain is of cheap material, the cheaper will the total gain become.

It is a fact of perhaps considerable importance in this connection that the younger animals eat more in proportion to their live weight than do older animals, and, therefore, have a larger proportion of their daily ration to use for the production of growth or fat. Or, to state it differently, doubtless a smaller proportion of their ration is required for mere maintenance. Whether these are all or even the principal causes, the fact of most importance remains unchanged, viz., that the cost increases with the age of the animal.

ADVANCE IN COST OF GAIN DUE TO AGE GREATLY EXAGGERATED.

The earlier figures on the saving from feeding the animals young, or in favor of making baby beef, were really startling to contemplate. In the face of these figures, it was absolutely certain that the man who fed anything except young animals was committing a stupendous blunder. The difficulty was the failure on the part of those who made the experiment to distinguish between the effect of age as distinguished from that of condition or fatness. In these experiments the young animals were not made fat, while the older animals were, and thus in the case of the young animals really the expensive part of the feeding process was avoided. I shall speak more in detail concerning this matter later. The point is, that the combined influence of age and of fatness was by these earlier experimenters ascribed to age alone, with the result that such data as the following were freely use in support of the baby beef contention.*

Cost per hundred pounds of gain up to 12 months of age	$ 4.03
" " " " " " between 12 and 24 mo	7.98
" " " " " " between 24 and 36 mo	12.54

In this connection it has always been maintained that older cattle could not be induced to make rapid gains, and that a gain of a pound and a half a day was a fair record for cattle two and a half years old and over, and that the young animals, therefore, not only made economical but rapid gains. This was tantamount to saying that the young animal could be finished in less time, or with a shorter feeding period, than the older animal, and that this wholly unwarranted conclusion was read into the figures by many inexperienced writers and advocates of this system of beef production.

In contrast with these figures some results obtained at the Texas Experiment Station* with range steers, ranging from four to six years old, and very thin in condition, should be considered. They were well warmed, i. e., they were gotten well accustomed to their feed before the experiment began, so that no part of this gain could be attributed to what is ordinarily called *fill*. The experiment ran through 79 days, and the results are as follows:

Lot I. Ten steers. Average weight, 671 pounds.

Ration: Cottonseed meal, silage and cottonseed hulls.

	Pounds.
Average daily gain	3.53
Grain per lb. gain	1.54
Silage per lb. gain	6.00
C. S. Hulls per lb. gain	3.70

---

*Chicago Stock Show results for 1882. Henry's "Feeds and Feeding," page 369.

*Texas Experiment Station, Bulletin No. 10.

Lot II. Steers. Average weight, 662 pounds.
Ration: Ear corn, silage, hay and cottonseed meal.

Average daily gain	2.81 lbs.
Cost of gain	2.67 cts.

Note the excellent gains made and the very remarkably small amount of feed required. The cost per pound of gain only was reported in the case of lot II, which, as will be observed, was 2.67 cents, or less than has ever been estimated even for calves, and yet these steers were from four to six years of age.

The point is, these animals were very thin in condition, and were carried through a very small part of the complete fattening period, namely, 79 days, and were not fat when the experiment closed. If they had been made thick fat and prime, the cost would have mounted far above these figures.

FIG. 6. A good class of two-year-olds in prime condition.

These data are presented merely to show that age in itself is not really so important a factor in the cost of gain as has been commonly supposed. In other words, the condition in which the animal is or the degree of fatness exerts a profound influence. This is clearly shown by some observations at the Kansas Experiment Station,* on three and one-half-year-old steers, warmed before the experiment began. They were fed a balanced ration of corn, bran, shorts and oil meal, and the experiment lasted 182 days, or six months, and cattle of this age in that time on such a ration should have become thick and prime.

---

*Kansas Experiment Station, Bulletin No. 34.

Average daily gain, 2.4 pounds; grain required for a pound of gain for the entire experiment, 10.0 pounds.

It is likely that on calves or yearlings with such a ration the grain required for a pound of gain would have been between seven and eight pounds, so that the age does affect the cost of gain.

But of great interest in showing condition of the animal upon cost of gain, note:

First 56 days they required only 7.3 pounds of food for a pound of gain.

First 84 days they required only 8.07 pounds of food for a pound of gain.

First 112 days they required only 9.01 pounds of food for a pound of gain.

First 140 days they required only 9.27 pounds of food for a pound of gain.

For the entire 182 days they required only 10.00 pounds of food for a pound of gain.

Note how the cost increases as the animal becomes fat. In former times this increase, due to fatness, has been invariably attributed to increase in age. In ordinary cases the cost does not increase so uniformly as the fattening process proceeds, as is shown in this particular case, for the reason that the season in a six months' period changes very materially, and may have the effect of accentuating this upward tendency in case an unfavorable time of year is hit upon for the finishing process, or this tendency may be partially, at least, offset when the finishing period falls in the cool, crisp autumn weather. But the weather being the same, the law seems to hold that as the animal increases in fatness the rate of gain diminishes and the cost of gain increases.

In addition to this increase in cost, due to fatness, there is, as has already been stated, an increase which appears to be due to the age of the animal, or, perhaps, more correctly speaking, due, principally, to the use to which the steer puts the feed, or the kind of gain he makes. When making sappy tissue, as in the case of the young animal, it is made cheaply; in making hard fat, as in the case of the older animal, it is more expensive.

THE DIFFICULTIES OF MAKING RELIABLE COMPARISONS.

It is evident that the problem is a complicated one, and that the difficulties in making reliable comparisons of the cost and value of production on cattle of different ages are both numerous and great, or in other words, to accurately measure the influence of age upon the cost and value of gain made by beef steers, is a very difficult undertaking.

It is owing to this fact that this question has not been settled in the public mind one way or the other long ago. There has certainly been sufficient discussion and really enough experimentation of a good character to settle an ordinary problem, but the work and discussions so far have tended to confuse rather than to crystallize public sentiment.

It is not proposed that the new data presented by us will by any means settle all of the numerous questions involved. They will, however, throw light upon some very important phases of the problem and tend to settle some details of practice along this line. They will, furthermore, it is believed, make some progress toward the definite solution of the whole problem, and suggest, perhaps, what other work of a fundamental character is necessary to finally solve the problem.

At this time, therefore, it seems that we are justified in undertaking a rather exhaustive and critical study of the data so far accumulated from all sources, as much to determine just where we are on this problem, and to mark out the proper course for future research as for the light these data will throw upon the feeders' practice.

DIFFICULTIES.

At first glance it would seem that the selection of two lots of cattle of different ages and of similar grade, and comprising a sufficient number of animals to eliminate as far as possible the pecularities of individuals, and the feeding of the same on the same kind of feed for the same length of time, would give data upon which a definite and final conclusion as to the relative cost of production on young and old cattle could be based, especially if the experiment were repeated often enough to make sure of reliable figures. This, however, is precisely what has been done a number of times, and done well, notably by the Ottawa Experiment Station, Ottawa, Canada, and by the Kansas Experiment Station, and the results so far as they go are perhaps thoroughly trustworthy.

If, however, the feeding operation be continued only long enough to make the older animals fat, the experiment closes before the young animals are finished, and they have, therefore, escaped the expensive period in the feeding operation, namely, the finishing. We have, therefore, introduced under this plan a disturbing factor, namely, the difference in condition of the animal. That a difference in condition exerts a profound influence upon the cost of gain, need not at this point be supported with experimetal data. It is a well accepted law in feeding, abundantly demonstrated in the scientific experiments of the stations and by the experience of the practical feeder.

Granting, therefore, that the young animals make gains at less cost, other things being equal, than do the older animals, it is equally true that the cost of gain on fat cattle is greater than on thin animals, and probably the difference between an animal thin in flesh and one that is thick fat is greater than that to be fairly attributed to difference in age, as between an eight or nine months old calf and a three-year-old steer, both being in the same condition or state of flesh.

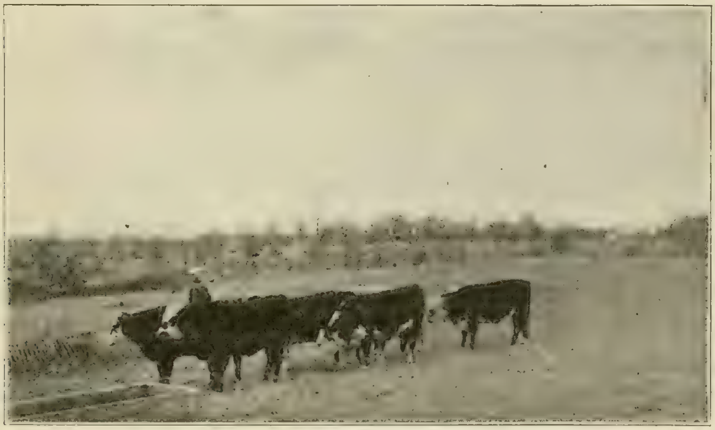


FIG. 7. Beginning to show finish.

Thus, by making the older animal thick fat, and stopping the experiment before the young animal is equally fat, we add to the increased cost due to age the increased cost due to additional fatness, and in the past we have ascribed this total difference to age alone, as has been already pointed out.

The exact difference in the cost of gain between the two classes of animals would depend upon their relative ages and the relative degree of fatness to which they were carried before the experiment closed. Other things being equal, the greater the difference in the ages of the cattle the greater would be the difference in their condition of fatness when the experiment closed, provided they were both fed an equal length of time. Therefore, the maximum difference due to this fact would be involved in the results of comparison of calves and three-year-olds, say. That is to say, the younger animals require a longer time to finish in, not because they make slower gains, but because they use a larger proportion of their food for the production of growth, and have left, therefore, a smaller proportion for the production of fat. The finish of an animal depends upon the amount of fat carried, and not upon the amount of growth it has made or upon its size. From the butcher's point of view, an animal is finished whenever it is fat.

The older and the nearer matured or grown the animal is, the shorter time will be required to make it fat, because of the smaller proportion of its feed that goes into the production of growth, and the larger the proportion that goes into the production of fat. In the case of animals that are fully grown, which are never met with in feeding practice nowadays, the entire digestible portion of the ration, except that required for maintenance, goes to the production of fat, and such animals, as is well known, fatten with great rapidity.

It has already been pointed out that growth is a cheap product, easy to manufacture, and commands a low price on the market, as witness the ease with which animals may be made to gain at pasture, likewise what a low price grazing or thin cattle bring on the market as compared with those which have been fed grain and have been fattened.

A glance at the results of all the experiments seeking to compare the cost of gain in old and young cattle will clearly reveal the fact that the older animals were made uniformaly fatter. This is self-evident when we realize that they were all fed the same length of time. It is further evidenced by the fact that the old cattle sold uniformly higher on the market. That is to say, taking the experiments at Ottawa, Kansas, and of Missouri Stations, there has been a direct and uniform relation between the age of the animal and the price that it has sold for on the market at the close of the experiment.

Note the following summary of prices brought by all cattle fed in these experiments at the different stations:

Selling prices of cattle at different ages in various experiments.

ONTARIO EXPERIMENT STATION.

1900—192 Days.

	Weight at selling time. lbs.	Selling price. Dollars.
Yearlings	1020	4.50
Two-year-olds	1230	4.65
Three-year-olds	1405	4.70

1901—203 Days.

Calves	780	4.50
Yearlings	1187	4.77
Two-year-olds	1302	5.00
Three-year-olds	1575	5.12½

1902—186 Days.

Calves	840	5.50
Yearlings	1298	6.17
Two-year-olds	1383	6.17
Three-year-olds	1597	6.17

1903—180 Days.

Yearlings	1263	5.25
Two-year-olds	1377	5.25
Three-year-olds	1553	5.25

1904—129 Days.

Yearlings	1050	4.75
Two-year-olds	1303	4.85
Three-year-olds	1530	5.00

KANSAS EXPERIMENT STATION.

1902-3—210 Days.

Calves	729	4.25
Yearlings	997	4.55
Two-year-olds.	1226	4.70
Three-year-olds	1433	4.95

MISSOURI EXPERIMENT STATION.

1905—210 Days.

Yearlings	1179	6.20
Three-year-olds	1698	6.75

1906—210 Days.

Yearlings	1295	6.35
Two-year-olds	1445	6.85

There is nothing in the Ottawa and Kansas reports to indicate that the quality of the cattle was not the same for the different ages. Certainly, it is true that the quality of the younger cattle in the Missouri experiments was fully equal to that of the older cattle. In truth, in 1905 and 1906 the quality of the younger cattle was decidedly superior to that of the older cattle.

All of this is not to be interpreted as showing that the younger cattle are necessarily at a disadvantage when sent to market. In fact, the older cattle have to face this disadvantage in the present market demands. This was especially true of the three-year-old cattle involved in the Missouri experiments for 1905, weighing as they did nearly 1,700 pounds on the market, and were, on account of their extra weight, in very light demand, with few buyers, and had it not been for their very prime condition, would have sold at a low price.

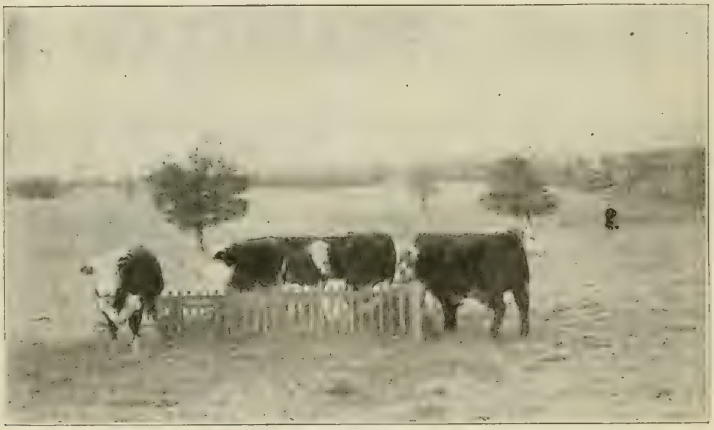


FIG. 8. Yearlings, thick and hard.

Therefore, other things being equal, the baby beef has an advantage over the older and heavier cattle when it goes to market, provided it is prime. To make it prime while still young constitutes one of the principal difficulties in making baby beef.

A FAIR COMPARISON WOULD BE TO MAKE THE CATTLE OF ALL AGES EQUALLY FAT.

It would seem, therefore, from the foregoing, that the only way to compare the cost of gain in young and old cattle would be to make both classes or ages equally fat. To feed them all an equal length of time would, as has already been pointed out, be unfair to the older cattle, inasmuch as they would be made fatter. This is precisely what has been done in the attempts to compare the economy of feeding cattle of different ages, notably in the Ottawa, Canada, and the Kansas experiments. In our own tests we have attempted to rectify this error, by making the cattle equally fat. This has necessitated in each case the feeding of the young animals a much longer time than the older ones, and the results of our tests, therefore, would seem to form a more accurate and reliable comparison than those made elsewhere, where the condition was wholly overlooked.

RESULTS OF EXPERIMENTS IN COMPARING CATTLE OF DIFFERENT AGES.

The most important work done along this line has been at the Ottawa Experiment Station, Canada, at the Kansas Experiment Station and by the Missouri Experiment Station, in co-operation with the Bureau of Plant Industry, United States Department of Agriculture, Washington, D. C., in charge of Professor F. B. Mumford, Professor of Animal Husbandry in the University.

It will be exceedingly valuable to bring the results of all these experiments together, computed in the same way and on the same basis, so that the results of one experiment may be fairly compared with those of another. I have, therefore, recalculated both the Canadian and the Kansas results and retabulated them so that they may be comparable with our results. There is no way to institute a reliable comparison of the cost of gain made at the different experiment stations, because different kinds of rations were used and the price put upon these feeds is not the same in all cases. I have, therefore, taken the price of the feeds used by each station as estimated by that station. It will be noted, furthermore, that the tests in Canada and Kansas were made in the winter, while the Missouri results were obtained by full feeding on bluegrass in summer.

INFLUENCE OF AGE UPON COST OF PRODUCTION.

Ottawa Experiment Station.

Age.	No. of steers in lot	No. of days on experiment.	Av. weight per steer at beginning, lbs	Av. weight per steer at close, lbs	Total gain per steer, lbs	Av. daily gain per steer, lbs.	Cost per 100 lbs. gain	Buying price of steer per 100 lbs	Selling price of steer per 100 lbs	Excess in cost of gain per 100 lbs. over calves	Excess in cost of gain per 100 lbs. over yearlings	Excess in cost of gain per 100 lbs. over 2-year-olds	Excess in cost of gain per steer over calves	Excess in cost of gain per steer over yearlings	Excess in cost of gain per steer over 2-year-olds	Excess in buying margin required to equalize excess cost:			Excess in selling price per 100 lbs. necessary to equalize excess cost of making:			Actual excess in selling price per 100 lbs.:		
																over calves	over yearlings	over 2-year-olds	over calves	over yearlings	over 2-year-olds:	over calves	over yearlings	over 2-year-olds
1900[1]																								
Yearlings	9	192	810	1020	213	1.11	$5.00	$3.25	$4.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....
Two-year-olds	9	181	960	1230	271	1.49	$6.20	$3.50	$4.65	.....	$1.20	.....	.....	$3.25	.....	.....	$ .34	.....	.....	$.26	.....	.....	.$.15	....
Three-year-olds	9	188	1120	1405	287	1.53	$6.80	$3.75	$4.75	.....	$1.80	$ .60	.....	$5 17	$1.72	.....	$ .46	$.15	.....	$.36	$.12	.....	.$.25	$.10
1901[2]																								
Calves	5	196	370	780	412	2.09	$3.24	$2.75	$4.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....
Yearlings	9	203	873	1187	315	1.55	$5.77	$3.38	$4.77	$2.53	.....	.....	$7.97	.....	.....	$.91	.....	.....	$.67	.....	.....	$.27	....	....
Two-year-olds	9	203	970	1302	332	1.58	$5.71	$3.50	$5.00	$2.47	$-.06	.....	$8.20	$—.20	.....	$.84	$-.02	.....	$.62	$.01	.....	$.50	$.23	....
Three-year-olds	9	203	1217	1575	358	1.76	$6.37	$4.25	$5.125	$3.13	$.60	$.66	$11.20	$2.15	$2.36	$.92	$.17	$.19	$.71	$.14	$.15	$.62	$.35	$.12
1902[3]																								
Calves	5	180	455	810	385	2.14	$3.60	$3.50	$5.50	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	....
Yearlings	9	186	953	1298	345	1.85	$4.65	$4.00	$6.175	$1.05	.....	.....	$3.62	.....	.....	$.38	.....	.....	$.28	.....	.....	$.67	....	....
Two-year-olds	9	186	1072	1383	311	1.67	$5.70	$4.00	$6.175	$2.10	$1.05	.....	$6.53	$3.26	.....	$.61	$.30	.....	$.47	$.23	.....	$.67	$00	....
Three-year-olds	9	186	1290	1597	307	1.65	$6.22	$4.50	$6.175	$2.62	$1.57	$.52	$8.01	$4.82	$1.62	$ 62	$.37	$.12	$.20	$.30	$.10	$.67	$00	$.00

1903[4]																								
Calves......	6	186	382	645	263	1.46	$5.34	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Yearlings	9	180	965	1263	298	1.65	$5.54	$4.90	$5.25	$.20	......	......	$.60	......	......	$.06	......	......	$.05	......	......	......	......	......
Two-year-olds..	9	180	1079	1377	298	1.65	$6.03	$4.90	$5.25	$.69	$.49	......	$2.05	$1.46	......	$.19	$.14	......	$.15	$.10	......	......	$ 00	......
Three-year-olds..	9	180	1269	1553	284	1.58	$7.05	$4.90	$5.25	$1.71	$1.51	$1.02	$4.86	$4.29	$3.07	$.38	$.34	$.23	$.31	$.27	$.19	......	$ 00	$ 00
1904[5]																								
Calves	5	152	386	653	267	1.75	$1.48	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Yearlings	8	129	808	1050	242	1.90	$5.62	$3.50	$4.75	$1.14	......	......	$2.76	......	......	$.34	......	......	$.26	......	......	......	......	......
Two-year-olds..	8	129	967	1303	327	2.53	$4.30	$3.90	$4.85	$-.18	$-1.32	......	$—.59	$-4.31	......	$.06	$-.44	......	$-.04	$-.33	......	......	$.10	......
Three-year-olds..	8	129	1236	1530	294	2.28	$5.22	$4.00	$5.00	$.74	$—.40	$.92	$2.18	$-1.17	$2.70	$.17	$-.09	$.22	$.14	$-.07	$.17	......	$.25	$.15
Average of all trials.																								
Calves..........	21	178.8	397.4	725.4	328.4	1.84	$4.22	$3.125	$5.00	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Yearlings	44	179.1	883.4	1166.18	283.52	1.605	$5.309	$3.892	$5.096	$1.23	......	......	$3.76	......	......	$.424	......	......	$.163	......	......	$.47	......	......
Two-year-olds..	44	176.8	1010.56	1319.36	310.84	1.768	$5.617	$3.961	$5.192	$1.30	$.308	......	$4.18	$.805	......	$.435	$.065	......	$.329	$.058	......	$.585	$.10	......
Three-year-olds..	44	178.2	1226.18	1531.81	306.27	1.748	$6.357	$4.286	$5.265	$2.08	$1.048	$.74	$6.69	$3.14	$2.28	$.532	$.257	$.18	$.345	$.206	$.149	$.645	$.17	$.07

---

[1] Annual report Experiment Farms for 1900, pp. 75-76.

[2] Annual Report Experiment Farms, pp. 280-281 (1901).

[3] Annual Report Experiment Farms, 1902, pp. 72-78.

[4] Annual Report, 1903, pp. 70-73.

[5] Annual Report Experiment Farms, pp. 64-66.

INFLUENCE OF AGE ON COST OF GAIN.

Kansas Experiment Station.

	No. steers in lot	No. days on expt	Average weight of steer at beginning	Average weight of steer at close	Total gain per steer	Average daily gain per steer	Cost per 100 lbs. of gain	Buying price of steers per 100 lbs	Selling price of steers per 100 lbs	Excess in cost of gain per 100 lbs. over			Excess in cost of gain per steer over			Excess in buying margin to equalize over			Excess in sell'g price necessary to equalize excess in cost over			Actual excess selling price per 100 lbs. over		
										Calves...	Y'rlings..	2 yr. olds	Calves....	Y'rlings..	2 yr. olds	Calves...	Y'rlings..	2 yr. olds	Calves....	Y'rlings..	2 yr. olds	Calves....	Y'rlings.	2 yr. olds
Calves, 6 months....	19	210	353	729	376	1.79	$4.01	$4.20	$4.25	......	......	......	......	......	......	......	......	......	......	......	......	......	......	......
Yearlings	20	210	570	997	427	2.00	$4.64	$4.20	$4.55	$ .63	......	......	$2.69	......	......	$ .47	......	......	$ .27	......	......	$ .30	......	......
2-year-olds............	20	210	808	1226	418	1.99	$5.44	$4.20	$4.70	$1.43	$ .80	......	$5.97	$3.34	......	$ .73	$ .41	......	$.48	$ .27	......	$ .45	$15.51	......
3-year-olds............	20	210	1003	1433	430	2.01	$5 95	$4.20	$4.95	$1.94	$1.31	$ .51	$8.34	$5.63	$2.19	$ .83	$ .56	$ .21	$ .58	$ .39	$ .15	$ .70	$ .40	$ .25

It will be well perhaps to discuss the Canadian and Kansas results separately from the Missouri results, inasmuch as they are for winter feeding while ours are for summer feeding, and for the further reason that no attempt was made by these experimenters to have the condition of the animals at the close of the experiment the same. On the basis, therefore, of feeding the cattle of the various ages the same length of time and on feeds of essentially the same character, it is to be observed:

1. That, on the whole, the calves gained somewhat more rapidly than did the older cattle, although the difference in the rate of gain between the cattle of the various ages is very small and might be easily attributed to difference in their condition.

It will be observed that the average of the five experiments at the Ottawa Station was as follows:

		Pounds.
Calves—	Average daily gain	1.84
Yearlings—	" " "	1.61
Two-year-olds—	" " "	1.77
Three-year-olds—	" " "	1.75

It is to be observed that in general the gains were low, which is to be accounted for by the fact that the feeding was done in the winter and the cattle were kept in a barn and were tied up, all factors affecting adversely the rate of gain and increasing somewhat the cost of gain.

In the case of the same experiment made at the Kansas Station, the younger animals gained less rapidly than did the older ones, as is shown by the following exhibit:*

		Pounds.
Calves—	Average daily gain	1.79
Yearlings—	" " "	2.00
Two-year-olds—	" " "	1.99
Three-year-olds—	" " "	2.01

This, taken in connection with the Missouri results, clearly contradicts the old notion that the rate of gain is necessarily much more rapid in young animals than in older ones when on full feed. This is only true when the older animals are fat.

EFFECT OF AGE UPON COST OF GAIN.

A study of these tables clearly reveals the relation between the age of the animal and the cost of gain. While it is true that not all of the difference shown in these experiments can be fairly attributed to difference in age, because the older cattle were undoubtedly fatter at the close of the experiment than were the younger ones, as is clearly shown by the increased price at which they sold, at the same time there is a definite relation between the cost of gain and the age of the animal.

FIG. 9. A part of the breeding herd of the Agricultural College. It is entirely feasible to make calves from such cows into baby beef.

For example, taking the average of all the Ottawa experiments, it is shown that the cost per hundred pounds of gain was as follows:

Calves	$4.22
Yearlings	5.31
Two-year-olds	5.62
Three-year-olds	6.36

In the case of the Kansas results, the rank in cost of gain was as follows:

Calves	$4.01
Yearlings	4.64
Two-year-olds	5.44
Three-year-olds	5.95

Thus, in the case of the Ottawa experiments, as between calves and three-year-olds, for example, the difference was $2.14 per hundred. In the Kansas results the difference was $1.94 per hundred in favor of the younger animal.

COST OF THE GAIN NOT THE ONLY FACTOR AFFECTING PROFIT.

The trouble heretofore in discussing the question of baby beef has been a failure, to recognize the fact that the cost of gain is not the only factor affecting the profits of the feeding operation, nor even in most cases the most important one. A small difference in the cost per hundred in buying the steer will easily offset what on the face of it is a large difference in the cost of gain. Or even a smaller difference in the selling price of the steer, due to superior condition, may easily offset what is at first glance a startling difference in the cost of making the animal fat. A difference of even $1.00 per hundred in the cost of gain seems so large as to be unsurmountable. At first glance, therefore, a practice carrying this great a difference is to be condemned.

It should not be forgotten, however, that this difference, even large as it may seem, applies only to a limited number of pounds. For example, a gain of from 375 to 500 pounds in weight will fit the ordinary steer for market, and a difference of $1.00 per hundred on this number of pounds in the cost of fitting the steer would affect the total cost of the animal only from $3.75 to $5.00. This means that on a steer weighing 1,000 pounds at the beginning of the feeding operation, if bought at from 37½ to 50c per hundred less on account of his age than another steer, this difference in cost would fully offset the difference required to fit him for the market. Or by feeding the animals of the different ages the same length of time, a difference in the selling price of 25 cents per hundred on a 1,400-pound steer would about offset the extra cost of gains made in fitting the steer for market.

The relation of age to the selling price of the feeder has already been discussed at some length, and the student is at this point referred again to that part of the article.

The question arises: what differences in the buying margin or in the selling price are necessary to fully offset or overcome the increased cost of the gains made in the fattening process by the older animal? Or, in other words, the practical question is: how much cheaper will a man be obliged to buy the older cattle than the calves or yearlings in order to offset the increased cost of gains, or how much more must the older animals sell for per hundred in order to overcome the increased cost of making them fit for market?

I have figured these factors out for each class of cattle in each of the foregoing experiments, and the results are clearly set forth in the preceding tables. This phase of the tabular data, already presented, will bear the most careful study of the feeder and student of beef production. These tables show:

That the increased cost due to age is most rapid during the first eighteen months of the life of the animal.

That after that point, while the cost increases, it mounts less rapidly than in the earlier life of the animal.

This is perhaps more clearly revealed by the Ottawa experiments, where the average of all the trials showed that the increased cost of

Yearlings over calves was	$1.25	per hundred pounds.
Two-year-olds over yearlings	.31	" " "
Three-year-olds over two year olds	.74	" " "

INCREASED BUYING MARGIN REQUIRED TO OVERCOME DIFFERENCE IN COST OF GAINS DUE TO AGE.

Calves and yearlings contrasted.—In the Ottawa experiments the difference in cost of gain on calves and yearlings varied all the way from 20 cents per hundred, in 1903, to $2.53 per hundred, in 1901. The average difference between these two classes of animals for all trials was $1.23 per hundred. On the basis of the actual gains made by these cattle, this difference in cost per hundred would make a difference of 60 cents per head in the one case and of $7.67 in the other, or an average difference for all trials of $3.76 per head for the entire fattening period. This figure is obtained by applying the excess in cost per hundred of gain on the yearlings to the actual number of pounds gained by them during the experiment.

The results of the one trial at the Kansas Experiment Station showed a difference of 63 cents per hundred in the cost of gain between calves and yearlings, which means, on the basis of the gains made by them, a difference of $2.69 per head.

To overcome this excess, taking the average weight of the cattle used in the Ottawa experiments, it would have been necessary to have bought the yearlings at 42 cents per hundred less than the calves.

In the case of the Kansas trial, it would have been necessary to have bought the yearlings 47 cents per hundred cheaper.

In other words, on the assumption that the calves would cost in the fall $5.00 per hundred, the yearlings would have been equally cheap, according to the Ottawa experiments, at $4.58 per hundred, and according to the Kansas experiment, at $4.53, provided, of course, that both classes of cattle brought the same price on the market when finished. Or, assuming for the moment that the buying price per pound on the two classes of cattle was the same, it would have been necessary to have sold the yearlings 32 cents per hundred higher, on the basis of the Ottawa experiments, or 27 cents per hundred higher, on the basis of the Kansas experiment, to have offset the difference in cost of gain. This means that with calves bringing $5.00 per hundred, the Ottawa yearlings would have had to bring $5.32 per hundred. In but two of the five years covered by the Ottawa experiments is the selling price of the calves given in the published reports. In one of these years (1901) the yearlings brought 27 cents per hundred more than did the calves, and in 1902 they brought 67 cents per hundred more, making an average of 47 cents, or more than enough to offset the whole difference in the cost of gain.

The 20 yearlings fed in the experiment at the Kansas Station brought on the Kansas City market 30 cents per hundred more than did the 19 calves used, both lots being sold on the same day and in direct competition, one with the other. This is also slightly more than was necessary to fully offset the excess in cost of gains.

CALVES AND TWO-YEAR-OLDS CONTRASTED.

As between calves and two-year-olds, the cost of gain shows even a wider variation than between calves and yearlings. In one season (1904) the cost of gain on two-year-olds was 18 cents per hundred less than that required for calves, whereas the maximum difference of the other was shown in the season of 1901, when the cost for calves was $2.47 per hundred less than for two-year-olds, or an average for all trials of $1.30 per hundred. This means that it cost all the way from minus 60 cents up to $8.20 per head more to make the gain required to fit the steer for market on the two-year-old animals than on the calf, the average difference being $4.18.

This would make it necessary to have an excess buying margin of 43 cents per hundred on two-year-olds, or an excess selling margin of 33 cents per hundred.

Again assuming that calves cost in the fall $5.00 per hundred, the feeder would have to buy the two-year-olds at $4.56; or, if the calves, when finished, brought $5.00 per hundred, the two-year-olds should sell at $5.33, in order to exactly overcome the difference in cost necessary to prepare them for market. It should be understood, of course, that this is on the assumption that the feeder will buy his cattle, and does not take into consideration any of the difference in cost required to raise the calves in the one case up to six months of age and the others to the age of two years.

The difference in the selling price of the calves and two-year-olds fed in the Ottawa experiments can only be determined in two trials, inasmuch as the selling price was reported for calves only in these two seasons. On the basis of these two, in the season of 1901 the calves brought $4.50 per hundred, and the two-year-olds brought $5.00 per hundred, or 50 cents more than the calves. In the season of 1902 the calves brought $5.50 per hundred, whereas the two-year-olds brought $6.17, making a difference of 67 cents per hundred, or an average difference for the two years of 58 cents. It will be observed that, according to our calculations above, a margin of only 33 cents was required to compensate for extra cost of gain on the older cattle.

On the basis of the Kansas results, the two-year-olds cost $1.43 per hundred more than the calves, or $5.97 per steer. To offset this it would have been necessary to have had an excess buying margin on the two-year-olds of 73 cents per hundred, or a selling margin of 48 cents per hundred to have fully equalized this difference in cost. As a matter of fact, the 19 calves used in this experiment sold on the Kansas City market, as has already been said, for $4.25 per hundred, while the 20 two-year-olds sold for $4.70 per hundred, making a difference of 45 cents in favor of the older cattle, or lacking three cents per hundred to fully offset the increased cost of gain.

CALVES AND THREE-YEAR-OLDS CONTRASTED.

Here the variation in cost in different years in the Ottawa experiments is likewise great and shows an extreme range of from 74 cents per hundred more for gains made on three-year-olds than on calves in 1904, to $3.13 per hundred, in 1901. The average difference in all the Canadian trials is $2.08 per hundred, or $6.69 per head in favor of the calves.

In order to overcome this excess in cost, it would be necessary to buy the three-year-olds for 53 cents per hundred less than the calves, or to sell them for 34½ cents more. Thus with calves at $5.00 per hundred in the fall, the three-year-olds would be, according to these experiments, equally cheap, considered on the basis of the cost of gain alone, at $4.47 per hundred. Or, if the calves brought $5.00 per hundred on the market, it would have been necessary for the three-year-olds to bring $5.34½ to fully offset the excess cost in making them ready for the market.

As has already been stated, the selling price of the calves in the Ottawa experiments was reported for only two seasons, viz., in 1901 and 1902. The prices brought by the calves and the three-year-olds in these two seasons were as follows:

	Calves	Three-year-olds.	Difference.
1901	$4.50	$5.12½	.62½
1902	5.50	6.17½	.67½

The average difference for both seasons was 65 cents, or more than sufficient to offset the increased cost required to make them ready for market.

In the case of the Kansas experiments, the three-year-olds cost $1.94 per hundred more than the calves, or an average of $8.34 per head. This would have required a buying margin of 83 cents per hundred for the three-year-olds, or a selling margin of 58 cents per hundred.

The calves, as has already been reported, brought $4.25 per hundred, while the 20 three-year-olds brought $4.95, or a difference in favor of the older cattle of 70 cents per hundred. This, as in the case of the Ottawa experiments, was more than sufficient to offset the increase required to fatten them

It cannot be too strongly emphasized that the older cattle did not bring this extra price, because they were older or bigger, but because they were fatter.

YEARLINGS AND TWO-YEAR-OLDS CONTRASTED.

As has already been pointed out, the difference between yearlings and two-year-olds is less than between calves and yearlings, probably because the bulk of the growth of the animal (the production of proteid tissue) has taken place, and there is less difference in the composition of the gain between yearling and two-year-olds than between calves and yearlings. Be this, however, as it may, the extreme range in cost between yearlings and two-year-olds varied from $1.32 in favor of the two-year-olds in 1904 to $1.20 per hundred in favor of yearlings in 1900. The average difference in all the trials at the Ottawa Experiment Station was only 31 cents per hundred in favor of the yearlings. It should be borne in mind, however, that in one of the trials at the Ottawa

Experiment Station, 1904, for some unexplainable reason, the cost on yearlings was excessively high, whereas the cost on two-year-olds was abnormally low. At least, these figures seem to be out of all proportion to the results in other years at the Ottawa Experiment Station, and at variance with the results obtained at Kansas and Missouri. Too much reliance, therefore, should not be placed in an average figure that involves results of this trial. It would really be better, for the sake of accuracy, to throw it out. Leaving it in, however, as has just been stated, the average difference was 31 cents per hundred in favor of the yearlings, or a total of 80 cents per steer. This would have necessitated a buying margin of six cents per hundred, or a selling margin of five cents per hundred. In other words, if yearling steers in the fall had been worth $4.50 per hundred, two-year-old steers, on the basis of these experiments, should have been bought for $4.43, or if the yearlings, when finished, had brought $5.50, it would have been necessary for the two-year-olds to have brought $5.55 to fully equalize this difference in cost. As a matter of fact, the two-year-old cattle brought, on the average, 10 cents per hundred more than did the yearlings.

Eliminating the results of the 1904 experiment on the ground that they are abnormal, we have an average cost of gain on yearlings of $5.21 per hundred and on two-year-olds of $5.79, or a difference of 58 cents per hundred, or approximately $1.78 per steer. This would necessitate a buying margin of 17 cents, or a selling margin of 13 cents.

On the basis of the Kansas results, the two-year-olds cost 80 cents per hundred more to make than did the yearlings, or an average of $3.34 per head. Thus it would have required, taking the actual weights of the cattle used in the Kansas experiment, an excess buying margin of 41 cents per hundred, or an excess selling margin of 27 cents per hundred. The selling margin was 15 cents per hundred, or an insufficient amount by $1.50 per head, or 12 cents per hundred, to counterbalance the excess in cost.

YEARLINGS AND THREE-YEAR-OLDS CONTRASTED.

Here is likewise a wide range in different years on the basis of the Ottawa experiments. In 1904, as has already been pointed out, for some reason the yearlings seem to have cost excessively high, and the cost of the two-year-olds and the three-year-ods was, curiously enough, very low. Thus it happened that it cost 40 cents per hundred less to put gains on three-year-olds that year than on yearlings, which is contrary to the results of all other years. The maximum difference in favor of the yearling was in 1900, when the yearlings showed a cheaper gain than three-year-olds by $1.80 per hundred. The average of all the experiments at Ottawa was $1.05 per hundred, amounting to $3.14 per steer, and requiring 26 cents buying margin, or 21 cents selling margin to overcome.

The three-year-olds actually sold for 17 cents per hundred more on the average than did the yearlings, showing that not all the difference due to increased cost of gain was counterbalanced by the extra selling price, and that some of it was left to be made up in a cheaper buy for the cattle.

Disregarding the superior selling qualities of the three-year-olds, if one had the opportunity of buying yearlings at $4.50 per hundred, computed on the basis of increased cost of gain alone, the three-year-olds would have been equally cheap at $4.24 per hundred. On the other hand, if it had been necessary to overcome this increased cost of gain by the extra selling price with yearlings bringing $5.50, it would have been necessary to have sold the three-year-olds at $5.71.

The Kansas results show a difference between three-year-olds and yearlings of $1.31 per hundred in favor of the latter in the cost of gain, or $5.63, necessitating a buying margin of 56 cents per hundred, or a selling margin of 39 cents per hundred. The 20 head of three-year-olds used in the Kansas experiment sold on the Kansas City market for 40 cents per hundred more than did the 20 yearlings used. Thus the older cattle, by reason of their superior selling quality, just offset the increased cost of gain. As has been before stated, the three-year-olds did not sell better, because they were older, or of a weight that was more desirable, but because they were fatter.

TWO-YEAR-OLDS AND THREE-YEAR-OLDS CONTRASTED.

If the reason already assigned for the smaller difference between yearlings and two-year-olds than between calves and yearlings is sound, then we should expect a smaller difference between two-year-olds and three-year-olds than between cattle of any younger ages, and such is the case.

The Ottawa experiments show a range of from 52 cents per hundred to $1.02 per hundred, with an average of 74 cents per hundred, all against the three-year-olds. This means that the three-year-old on the average cost $2.28 per head more to make ready for market than did the two-year-old, taking the actual gains made by each lot as a basis of computation. To offset this difference, it would have been necessary to have bought the three-year-olds at 18 cents per hundred less, or to have sold them at 15 cents per hundred more. In these experiments the excess in selling price of three-year-olds over two-year-olds was only seven cents per hundred, leaving about half of the difference yet to be made up in some other way. Thus, if the two-year-olds could have been bought at $4.25 per hundred in the fall, three-year-olds would have been equally cheap at $4.07, on the basis of cost of gains alone and disregarding any greater ease with which they might have been fattened, any greater uniformity with which they would become fat, etc.

In the case of the Kansas experiment, the difference was 50 cents per hundred, or $2.19 per head, and required an excess in buying margin of 21 cents, or an excess in selling price of 15 cents per hundred. It happened that the 20 three-year-old steers used in this experiment sold for 25 cents per hundred more than did the 20 two-year-olds, thus fully offsetting the $2.19 excess in cost of making, and leaving, on the basis of the actual gains made in the experiment, a margin of $4.30 per steer in favor of the three-year-olds, due to the superior condition, no doubt, in which the older cattle reached the market, all having been fed an equal length of time.

Before considering the Missouri results, which are on a different basis, it is obvious that if cattle of equal quality and in the same condition of the various ages, calves, yearlings, two-year-olds and three-year-olds, are fed alike on good nutritious feed, and are all fed the same length of time, or until the older cattle become fat, and the whole put upon the market, the increased cost due to age and to increased fatness will apparently be fully or practically offset or counterbalanced by the increased price commanded by the older cattle.

If these experiments point to the truth, that is, if the difference in the cost of gain is fully or even approximately offset by the superior selling quality of the older cattle, then the greater cheapness with which the older feeders can be bought on the market, as is well known by any professional feeder, and as has already been pointed out in this paper, leaves a very decided advantage in favor of feeding the older cattle, even when we disregard the greater uniformity with which the older cattle will fatten, the less risk from failure to fatten, from loss due to dehorning or vaccination against blackleg, and so forth, and so on.

Attention has already been called to the fact that this is not a fair test of the baby beef question, because the intelligent feeder will not send his younger animals to market in the unfinished condition that these younger animals were, but will feed them until they reach as high a selling price per hundred pounds as the older cattle. In that case, however, as will be very strikingly shown by the Missouri results, the difference in the cost of gains between younger and older cattle is very much reduced, because in that case we have only the manifestation of the influence of age, whereas in the experiments in Canada and Kansas, as just cited, we have the combined influence of age and condition. This phase of it, however, will be discussed more in detail in connection with the Missouri results which are to be presented.

MISSOURI RESULTS.

(This is a part of a series of experiments to ascertain the feeding value of different forage plants, carried on by the Missouri Experiment Station, in co-operation with the Bureau of Plant Industry of the United States Department of Agriculture, and under the management and direction of Professor F. B. Mumford, Professor of Animal Husbandry.)

As has already been stated, in the feeding trials conducted at the Missouri Station an attempt was made to eliminate any difference in condition of the animals of different ages, by feeding the younger animals a longer period of time, or by feeding all classes of animals until they were prime. To do this we had choice of two methods, viz.:

To begin all of the cattle at the same time, which would necessitate the finishing of them at different times, and the marketing of them at periods somewhat remote one from the other, so that the selling price could not be accurately gauged.

The other plan was to begin the older cattle enough later in the season, so that they and the younger cattle would be finished for market together. This had the advantage of enabling us to market the cattle at the same time, but had the disadvantage of having the earlier feeding period of the younger cattle extend back into a season of the year that is less favorable for making gains than that of the main experiment. Throwing the records of the feeding period of this time of year out of consideration entirely, and considering only the results during the period when the older cattle, as well as the younger cattle, were on full feed, introduces an error, inasmuch as the condition of the two classes of cattle is somewhat different at the beginning of the test. Inasmuch, however, as these are inevitable conditions in any attempt to finish cattle for a given time, it was decided to choose the latter method and to attempt to finish the cattle together. Accordingly comparisons were made with yearlings and two-year-olds and with yearlings and three-year-olds.

It was planned to finish both classes of cattle in each season for the Christmas market, being actually put upon the market about the first week in December. In order to have the yearlings in prime condition at this time, it was necessary to begin feeding them at least as early as December 1st of the previous winter, and to practically full feed them until grass, and to continue full feeding at pasture until they were shipped to market. On the other hand, the three-year-olds were roughed through the winter, many of them on only sufficient food to maintain their weight without making any gain, and the others so fed as to make but slight gains. When pasture was good, say about the first of May, they were turned into good bluegrass pasture and put on about half grain feed for May and June, and full fed from July until the first week in December, when the experiment closed.

In the case of the two-year-olds, essentially the same method of wintering was employed as with the three-year-olds, but they were rather more than half grain fed, on the average, during May and June, and were full fed the rest of the season, in each case, of course, on bluegrass pasture.

For the purposes of the present discussion, and to avoid complicating the problem unduly, we are considering only the results of the feeding trial from the time all the cattle went to pasture, about the first of May, until they were marketed. The gains made, the cost of the same and the profit or loss of each class during the preceding winter bear intimate relation to the outcome of the whole undertaking, but will be considered under a separate head.

In other words, we are dealing with this experiment as though the professional feeder bought his animals on May 1st for the summer with the determination to fit them for the Christmas market, and that in order to do this it would be necessary, if he chose the younger animals, to buy them fatter than if he took the older ones.

These experiments covered three years' work, as follows:

In 1904, a comparison of yearlings and two-year-olds, on four different rations.

In 1905, a comparison of yearlings and three-year-olds, on four different rations.

In 1906, a comparison of yearlings and two-year-olds, on four different rations.

INFLUENCE OF AGE UPON THE COST OF PRODUCTION.

(Missouri results in co-operation with Bureau of Plant Industry, U. S. Department of Agriculture.)

Summer feeding on bluegrass pasture. Length of feeding period, 211 days. First trial, 1904. Yearlings and 2-year-olds compared.

	No. steers in lot	Av. weight at begin'g	Av. weight at close	Total gain per steer	Average daily gain	Cost per 100 lbs. of gain*	Excess in cost per 100 lbs. of gain over yearlings	Excess in cost per steer for season's gain over yearlings	Excess in buying margin necessary to equalize cost of gain over yearlings	Excess in selling price per 100 lbs. necessary to equalize difference in cost of gain over yearlings
Linseed meal, 3 lbs. per head daily, and shelled corn ad libitum.										
Yearlings	8	762	1259	497	2.36	$6.46	......	......	....	....
Two-year-olds	7	932	1490	557	2.64	$6.73	$ .27	$1.50	$ .16	$ .10
Cottonseed meal, 3 lbs. per head daily, and shelled corn ad libitum.										
Yearlings	8	757	1209	452	2.14	$6.23	......	......	....	....
Two-year-olds	7	942	1481	539	2.55	$6.73	$ .50	$2.69	$ .27	$ .18
Gluten feed, 3 lbs. per head daily, and shelled corn ad libitum.										
Yearlings	7	774	1217	443	2.10	$6.20	......	......	....	....
Two-year-olds	7	940	1456	515	2.44	$6.66	$ .46	$2.37	$ .25	$ .16
Shelled corn alone.										
Yearlings	7	760	1204	444	2.11	$5.31	......	......	....	....
Two-year-olds	6	943	1433	490	2.32	$5.88	$ .57	$2.80	$ .29	$ .19
Average of all rations.										
Yearlings	30	763	1223	456	2.18	$6.06	......	......	....	....
Two-year-olds	27	939	1466	526	2.49	$6.52	$ .44	$2.32	$ .24	$ .18

*In computing cost of gain, the following prices of feed were assumed:

Corn, 40c per bu.

Cottonseed meal, $24.00 per ton.

Linseed meal, $28.00 per ton.

Gluten feed, $22.00 per ton.

No charge was made for cost of pasture, and no credit was given for hog gains nor for value of manure.

INFLUENCE OF AGE UPON THE COST OF PRODUCTION.

(Missouri results in co-operation with Bureau of Plant Industry, U. S. Department of Agriculture.)

Summer feeding on bluegrass pasture. Length of feeding period, 210 days. Third trial, 1906. Yearlings and 2-year-olds compared.

	Total No. steers fed....	Av. weight at begin'g...*	Av. weight at close....	Total gain per steer....	Average daily gain per steer........	Cost per 100 lbs. of gain.	Excess in cost per 100 lbs. gain over yearlings........	Excess in cost per steer for season's gain over yearlings........	Excess in buying margin necessary to equalize cost of gain over yearlings........	Excess in selling price per 100 lbs. necessary to equalize difference in cost of gain over yearlings........	Actual selling price per 100 lbs.*........	Excess in selling price per 100 lbs. over yearlings........
Linseed meal and shelled corn.												
Yearlings.......	7	859	1320	461	2.18	$5.58	......	......	....	....	$6.75	......
Two-year-olds .	7	875	1440	566	2.69	$5 58	$ 00	$ 00	$ 00	$ 00	$7.00	$ .25
Cottonseed meal & shelled corn.												
Yearlings	7	858	1299	441	2.10	$5.63	......	......	....	....	$6.60	......
Two.year-olds.	7	861	1431	570	2.72	$5.67	$ .04	$ .23	$ .03	$3 .02	$7.00	$ .40
Corn with linseed meal last 60 days.												
Yearlings	7	861	1311	450	2.14	$5.26	......	......	....	....	$6.75	......
Two-year-olds..	7	886	1470	584	2.78	$5.37	$ .11	$ .64	$ .07	$ .04	$7.00	$ .25
Shelled corn.												
Yearlings.......	7	859	1250	391	1.86	$5.28	......	......	....	....	$6.60	......
Two-year-olds..	7	886	1438	552	2.63	$5.52	$. 24	$1.32	$ .15	$ .09	$7.00	$ .40
Average of all rations.												
Yearlings	28	859	1295	435	2.07	$5.43	......	......	....	....	$6.67	......
Two-year-olds..	28	877	1444	568	2.70	$5.53	$ .10	$ .54	$ .05	$ .04	$7.00	$ .33

*On December 3, 1906, Mr. John Alexander, of the commission firm of Alexander, Ward & Conover, Chicago, placed the above values on the cattle of the various ages fed that season. They were sold on the Chicago market December 10, 1906. The 28 head of yearlings brought $6.35, and the 28 head of 2-year-olds brought $6.85.

SUMMARY OF FIRST AND THIRD TRIALS, 1904 AND 1906, YEARLINGS AND TWO-YEAR-OLDS.

Influence of Age on Cost of Production.

	Total No. steers fed....	Av. No. of days on experiment...........	Av. weight at beginning of experiment...	Av. weight at close of experiment.........	Av. gain per steer......	Av. daily gain per steer	Cost per 100 lbs. gain*..	Excess in cost per 100 lbs. gain over yearlings..................	Excess in cost per steer for season's gain over yearlings..........	Excess in buying margin necessary to equalize difference in cost of gain over yearlings.	Excess in selling margin necessary to equalize difference in cost of gain over yearlings....	Actual selling price per 100 lbs*..................	Excess in selling price per 100 lbs. over yearlings..................
Linseed meal & corn.													
Yearlings	15	210	807	1287	480	2.28	$6.05	......	......	....	....	$6.75	......
Two-year-olds	14	210	903	1465	561	2.67	$6.15	$ .13	$ .70	$ .08	$ .05	$7.00	$ .25
Cottonseed meal and corn.													
Yearlings	15	210	807	1251	446	2.12	$6.04	......	......	....	....	$6.60	......
Two-year-olds	14	210	901	1456	554	2.63	$6.20	$ .27	$1.46	$ .15	$ .10	$7.00	$ .40
Gluten feed and corn (1904 only)													
Yearlings	7	211	760	1204	444	2.11	$5.31	......	......	....	....	......	......
Two-year-olds	7	211	940	1456	515	2.44	$6.66	$ .46	$2.37	$ .25	$ .16	......	......
Linseed meal last 60 days and corn (1906 only).													
Yearlings	7	210	861	1311	450	2.14	$5.26	......	......	....	....	$6.75	......
Two-year-olds	7	210	886	1470	584	2.78	$5.37	$ .11	$ .64	$ .07	$ .04	$7.00	$ .25
Corn alone.													
Yearlings	14	210	809	1155	410	1.98	$5.30	......	......	....	....	$6.60	......
Two-year-olds	13	210	912	1435	523	2.49	5.69	$ .39	$2.00	$ .21	$ .14	$7.00	$ .40
Average of all rations for both years.													
Yearlings	58	210	810	1257	446	2.12	$5.76	......	......	....	....	$6.67	......
Two-year-olds	55	210	907	1454	547	2.60	$6.02	$ .27	$1.42	$ .15	$ .11	$7.00	$ .33

*The value of the cattle at the close of the experiment in 1904 was not determined for either yearlings or two-year-olds. The selling prices in the table above are for the different lots fed in 1906, as determined December 3rd of that year and just before the close of the experiment, by Mr. John Alexander, of the commission firm of Alexander, Ward & Conover, Chicago. A week later all the yearlings and all the two-year-olds were sold on the Chicago market on the same day, and brought: yearlings, $6.35; two-year-olds, $6.85.

INFLUENCE OF AGE ON COST OF PRODUCTION.

(Missouri results in co-operation with Bureau of Plant Industry, U. S. Department of Agriculture.)

Summer feeding on bluegrass pasture. Length of feeding period, 210 days. Second trial, 1905. Yearlings and 3-year-olds compared.

	No. steers in lot	Av. weight at begin'g	Av. weight at close	Total gain per steer	Av. daily gain	Cost per 100 lbs. of gain	Excess in cost per 100 lbs. gain over yearlings	Excess in cost per steer for season's gain over yearlings	Excess in buying margin necessary to equalize cost of gain over yearlings	Excess in selling price per 100 lbs. necessary to equalize difference in cost of gain over yearlings	Actual selling price per 100 lbs	Excess in selling price per 100 lbs. over yearlings
Linseed meal, 3 lbs. daily, and shelled corn.												
Yearlings	8	723	1201	478	2.28	$5.92	......	......	....	....	$6.20	......
Three-year-olds	7	1264	1733	469	2.23	$7.05	$1.13	$5.30	$ .42	$ .31	$6.80	$ .60
Cottonseed meal, 3 lbs. daily, and shelled corn.												
Yearlings	8	734	1183	449	2.14	$6.03	......	......	....	....	$6.20	......
Three-year-olds	7	1269	1688	419	2.00	$7.58	$1.15	$4.81	$ .38	$ .30	$6.80	$ .60
Gluten feed, 3 lbs. daily, and shelled corn.												
Yearlings	7	733	1178	445	2.12	$5.87	......	......	....	....	$6.20	......
Three-year-olds	6	1254	1730	475	2.26	$6.52	$ .65	$3.09	$ .25	$ .18	$6.80	$ .60
Shelled corn alone.												
Yearlings	7	729	1153	424	2.01	$5.18	......	......	....	....	$6.20	......
Three-year-olds	6	1251	1643	392	1.87	$7.20	$2.02	$7.92	$ .63	$ .42	$6.80	$ .60
Average of all rations												
Yearlings	30	729	1179	449	2.14	$5.75	......	......	....	....	$6.20	......
Three-year-olds	26	1259	1698	439	2.09	$7.09	$1.24	$5.28	$ .42	$ .30	$6.80	$ .60

DISCUSSION OF RESULTS.

YEARLINGS AND TWO-YEAR-OLDS COMPARED.

It will be noted in the Missouri results that not a single lot of yearlings in either year made as rapid gains as did the corresponding lot of two-year-olds. The average daily gain of all lots in 1904 was as follows:

Yearlings	2.18 pounds
Two-year-olds	2.49 "

In 1906 the difference is even more striking, as follows:

Yearlings	2.07 pounds.
Two-year olds	2.70 "

It is believed that this difference was due primarily to the condition of the animals when the feeding trial began. As has already been made clear, the yearlings had been full fed for a considerable time before the experiments proper began, whereas the two-year-olds had been merely roughed, and were in thin condition. Thus they entered this experiment with a large appetite and with the maximum capacity for gain and the minimum of maintenance cost per steer in proportion to their appetite.

Expressing the results in the total gain made per steer during the experiment, the time in each case being the same, it will be noted that in 1904 the yearlings gained, on an average, 456 pounds, whereas the two-year-olds gained 526 pounds, or 70 pounds per head more in the same length of time, both being full fed. In 1906 the total gain per steer for the yearlings was 435 pounds, while for the two-year-olds it was 568 pounds, or 133 pounds more for the season. It will be recalled that in this year the two-year-olds were a little more than half fed during the first two months of the experiment, and were gotten on full feed toward the end of June.

The average of the two years' trials for all rations, and involving 113 cattle, was 446 pounds of gain for the season for the yearlings and 547 pounds for the two-year-olds, or a difference of 101 pounds.

Concerning the cost of gains, the student of these tables will have already noted that the difference between the yearlings and the two-year-olds is smaller than it was in the Canadian and the Kansas experiments already referred to. For example, in 1904, the maximum difference in the cost per hundred pounds of gain in favor of the yearlings was 57 cents with the shelled corn lot, and the minimum difference was 27 cents per hundred with the corn and linseed meal lot. The average of all lots for that year was 44 cents per hundred. In 1906 the maximum difference was 24 cents per hundred, and was again shown by the shelled corn lot, and the minimum difference was 0, which was again the corn and linseed lot. The average of all lots for that year was 10 cents per hundred.

The average for both years, and including the 113 cattle fed, was only 27 cents per hundred.

It will be recalled that a difference as high as $1.20 per hundred was shown in one of the Ottawa trials, and the Kansas experiment showed a difference of 80 cents per hundred.

It was expected that the difference in cost of gain between yearlings and two-year-olds would be less in the Missouri experiments than in the other trials reported, for the reason that there was less difference in the condition of the animals at the close. That is, the two classes of animals were more nearly uniform in degree of fatness at the close of the trials at the Missouri Station than was the case at Ottawa or Kansas.

In one sense, it would be fairer to take the entire record of the yearlings, from the time they were put on full feed the previous Christmas time until they were marketed, and the record of the two-year-olds, from the time they were put on full feed, May 1st. If this were done, it is certain that the difference in the cost of gain would be larger than the results here given show, because the yearlings as well as the two-year-olds would have had the advantage of the earlier portion of the feeding period, when the cost of gains is relatively low. For the purposes of this discussion, however, as before intimated, we are taking the view of the professional feeder, who buys his feeders for delivery about May 1st, and who, if buying yearlings, to make prime for the following Christmas market, would necessarily buy animals that had been well warmed, and if buying older cattle, would not require them to be carrying the flesh that the younger ones would have to finish at the same time. It is believed, therefore, that the method employed in this discussion will be more nearly adapted to the commercial practices, and the figures given will be more nearly applicable to the conditions of summer feeding in the corn belt than would the incorporation of the wintering data with the summer feeding results.

The difference noted in the cost per hundred pounds of gain in the Missouri experiments in the first trial, in 1904, ranged all the way from $1.50 to $2.80 per head, with an average of $1.32 per head, when the difference per hundred pounds between yearlings and two-year-olds is applied to the total season's gains made by the latter. This means that had the feeder been intending to use shelled corn on bluegrass, it would have been necessary for him to have bought his two-year-olds, according to that year's results, at 29 cents per hundred less than his yearlings, or to have sold them for 19 cents per hundred more. Had he been intending to combine with his shelled corn a limited amount of linseed meal, he would need to have bought his two-year-olds for 16 cents per hundred less, or to have sold them for 10 cents per hundred more, to have overcome all the difference in cost of gain due to age. The average of all the rations for that year would have necessitated the buying of the two-year-olds at 24 cents per hundred less, or selling them at 18 cents per hundred more. Unfortunately, the cattle were not so marketed at the close of this trial as to enable us to ascertain what the relative selling value of the two classes was.

On the basis of the second trial, made in 1906, the feeder using shelled corn alone would have had to buy his two-year-olds 15 cents per hundred lower than yearlings, or to sell them at nine cents per hundred more. A glance at the table of results for this trial will show that the two-year-olds fed on corn sold for 40 cents per hundred more than did the yearlings so fed. In case the feeder used shelled corn with a limited amount of linseed meal, on the basis of the 1906 results, the yearlings and the two-year-olds might have been bought at the same price and sold at the same price and returned the same profit. In other words, as has already been pointed out, there was in this particular lot of cattle no difference whatever in the cost of gain. It will be noted that at the close of the experiment Mr. Alexander estimated the yearlings fed on this ration to be worth $6.75 per hundred and the two-year-olds $7.00 per hundred, or a difference of 25 cents per hundred in favor of the older cattle, not because the older cattle had superior quality, for they had not, but because they were a little thicker and harder. The average of all the lots fed in 1906 showed that it would have been necessary to have purchased the two-year-olds at five cents per hundred less, or to have sold them at four cents per hundred more, than the yearlings to have overcome the difference in cost of gains made. It will be furthermore noted that Mr. Alexander estimated an average difference in the selling value of these cattle at the close of the experiment of 33 cents per hundred in favor of the older cattle.

It will be recalled, from the foot note to the table of results for that year, that the actual price brought on the Chicago market by the yearlings was $6.35 per hundred and for the two-year-olds on the same day $6.85, or an actual difference of 50 cents per hundred. It was conceded by all parties that the younger cattle had rather the advantage in quality over the older class, but it was uniformly conceded that the older cattle were in more nearly prime condition.

YEARLINGS AND THREE-YEAR-OLDS COMPARED.

As in the case of the two-year-olds in these experiments, the three-year-olds had been roughed through the winter, and were in thin flesh when they entered upon this experiment. On the other hand, the yearlings had been practically full fed since February, and were, therefore, carrying considerable flesh. Notwithstanding this difference in condition, it is a very striking fact that the three-year-olds made on the average a smaller gain than did the yearlings. This is illustrated by the fact that the average daily gain for all the yearlings was 2.14 pounds daily, and for all the three-year-olds it was 2.09 pounds. In but one lot, namely, that fed on corn and gluten feed, did the three-year-olds gain more rapidly than the yearlings. It is true that the three-year-olds were finished to a degree that none of the other cattle in this experiment had ever been brought to, and it is likely that in the last 60 days of the feeding period these older cattle produced very small increase in weight, which would have the effect, of course, of materially reducing the average rate of gain for the whole feeding period. This is a matter of too much detail to go into in the discussion here, and the student who is interested in this subject is referred to a bulletin soon to be issued by the Experiment Station, by Professor F. B. Mumford, Professor of Animal Husbandry, in which all of such details will be discussed most carefully.

In studying our results with yearlings and three-year-olds, it should be borne in mind that we have but one trial, and conclusions formed should be subject to confirmation by trials now in progress. In fact, it will be safer to reserve final judgment until more data are accumulated. At the same time, it will be interesting to note the trend of these results.

It will be observed, as might be expected, that the difference in cost of gains between yearlings and three-year-olds is materially larger than was that noted between yearlings and two-year-olds. For example, the maximum difference shown between the yearlings and three-year-olds having corn alone amounted to $2.02 per hundred, which, applied to the gain made by the three-year-olds for the season, is $7.92 per steer. The minimum difference in this trial was between the lots fed on corn and gluten feed, and amounted to 65 cents per hundred, or $3.09 per steer for the entire fattening period. The average of all the lots shows a difference of $1.24 per hundred, or $5.28 per steer. In order to overcome this excess in cost of gain, it will be necessary to buy three-year-olds, on the basis of the results with shelled corn alone, at 63 cents per hundred less than yearlings, or to sell them when finished at 42 cents per hundred more, whereas in the case of the gluten-fed lot the buying price for the three-year-olds need only be 25 cents per hundred less, or the selling margin 18 cents per hundred more. The average of all the lots shows that a difference in the buying price of 42 cents per hundred would need to be made in favor of the three-year-olds, or a selling difference of 30 cents per hundred, in order to fully offset the increased cost of gains.

It is of interest to note that the average selling price of the yearlings in this experiment was $6.20 per hundred and of the three-year-olds 6.80, or a difference in favor of the older cattle of 60 cents per hundred. It should be stated, however, that these figures are not strictly comparable, inasmuch as the two classes of cattle were not sold on the same market and were marketed a week apart. In fact, out of the three-year-olds a show lot of fifteen head were selected and exhibited at the Pittsburg Fat Stock Show, where they won second prize and brought at auction the following day $7.10 per hundred, which was the record price for the year in any market for cattle of that weight, viz.: 1,700 pounds. The eleven discards were sold in St. Louis on the way to Pittsburg for $6.40 per hundred, making an average for the entire lot of $6.80. A week later, on a less favorable market, the yearlings were offered in St. Louis and later sold in Chicago for an average of $6.20 per hundred.

In practically all the trials, therefore, it seems that the older cattle sold for practically enough more per hundred pounds than the younger animals, to fully offset the difference in cost of gains required to fit them for market. If these data may be relied upon in this matter, then the advantage in cutting down the cost of gains by feeding young animals is neutralized by the higher price for which the older animals sell, in case they are both fed something near the same length of time.

Eliminate this difference in selling price by making both classes equally fat, and the large difference in the cost of gains reported especially for the earlier trials will be very materially reduced. To what point they will be reduced remains for future investigations to determine.

Reference has already been made to the influence of age upon the cost of feeders, and it was there shown that a six-months-old calf, at weaning time, brings on the average a higher price per pound than at any subsequent period in its life, except when finally put in marketable condition by being made fat. It is furthermore shown that between the calf and the yearling form in the stocker or feeder condition there is a very large drop in price per pound. That the curve of cost from this point slowly rises through the two-year-old form up to the three-year-old state, when it reaches its second highest point in the life of the unfatted steer. The animal just before weaning time, carrying its calf fat and milk bloom, looks its best, and is never so attractive in appearance again until fully fattened and ready for the market. The carcass is, however, at that stage watery, subject to heavy and rapid shrinkage, and requires during the weaning, dehorning and vaccination against blackleg periods expensive feeds even to maintain the normal weight. There does not appear to be anything in the results of all of these experiments, however, to justify the large drop in the value per pound between the calf and the yearling stage when in ordinary thin condition. It is true that the animal at this age still manifests a strong tendency to grow; that this materially retards the fattening process and makes the professional feeder wary of the yearling. This closes to this aged animal the most important market, the feeder, and leaves it only in demand by the man who desires to grow it still further and subsequently sell it as a feeder. The man who proposes to grow this animal needs a margin of profit over and above the value of the actual gains made, which may account for this large decline in price over the younger animal and even over the same animal the following year when in its two-year-old form.

Considering the relative ease with which a two-year-old may be made ready for market, justifies the paying of a somewhat higher price for him in the feeder condition than the yearling commands. On the other hand, there seem to be but two possible explanations why the three-year-old should bring more per pound as a feeder than a two-year-old, viz.: The somewhat shorter time required to fit him for market, and the slightly smaller risk involved in handling him and in making him fat. That is to say, the uniformity with which animals will fatten is directly proportionate to its age. Or, the percentage of culls or unfatted animals at the end of the feeding period will be inversely proportionate to the age.

In the light of all the experimental data here presented, it would seem, however, that the increased cost of gains on three-year-olds over two-year-olds is large enough to demand that the three-year-olds be bought at even less per pound than the two-year-olds, instead of having to be bought even for the same, and that the professional feeder is making a mistake when he pays more per pound for three-year-olds than he would be required to pay for two-year-olds of the same quality.

It goes without saying that animals of great uniformity, fine finishing and early maturing qualities are required if they are to be fitted for the market in the calf form. The coarse, common, rough steer will mature too slowly and manifest too strong a tendency to grow and become fat with too great uncertainty to be handled profitably in this way. When in his two or three-year-old form, when most of the tendency to grow has been satisfied, this same animal will as a rule fatten rapidly and sell when fat for a fair price.

The difficulty of getting together a sufficient number of young animals of a quality that would justify the fattening of them as calves, and the usual high price which animals of this quality command, and the cost of buying them one or two in a place, all influence in a marked way the practice of the feeder. It cannot be too strongly emphasized that thus far the whole question has been considered from the view point of the professional feeder, or the man who buys cattle, puts them in his feed yards, fits them for market and sells them. To him, as has been before pointed out, it is a matter of supreme indifference what ages of cattle he feeds or what these animals may have cost the man who raised them, so long as he is permitted to buy them at a price that will enable him to fit them for market at a profit. It may be accepted, therefore, as final, that so long as he can buy the older cattle with sufficient margin to fully overcome the increased cost of gains made in his feed yard, he will consider it to his advantage to feed them in preference to younger animals, in view of the fact that they have at that age been already bunched and can be bought by the carload or the hundred in fairly uniform condition and of uniform age, size, color and quality, because they may be fitted for market in much less time, will fatten more uniformly, will require less careful attention, etc.

THE CATTLE RAISER THE MAN WHO IS INTERESTED IN BABY BEEF.

We cannot escape the conclusion, therefore, that the man who raises cattle is the one who is primarily interested in baby beef production. No one familiar with the facts doubts for a moment that if the feeder had to raise his own cattle or to pay for the two or three-year-old steer on the basis of what it has cost to produce him, plus a fair profit to the raiser, rather than what it will cost to fit him for market; in short, if the feeder had to pay as much more per pound for the three-year-old than for the calf as the three-year-old costs on the high-priced land of the corn belt, there would no longer be cattle of this age on the market. Even pasturage on the ranges is getting so scarce and dear that the cattle raisers alreadly seriously consider the forcing of the feeder to buy their cattle younger, in order to cut down the expense of making them. It is a far cry from the heavy, aged bullock marketed twenty-five years ago to the two-year-old steer now found on our markets. This sharp tendency toward making cattle younger will be even more marked in the next quarter of a century, because of the great advance in the price of land in the range country as well as in the corn belt. But before the largest progress in this direction can be made, it will be necessary to interest the breeders. In short, from this time on it is more problem for the breeder than for the feeder. Animals that are capable of and worth being made into baby beef must be bred, not by isolated individuals, but by whole communities and entire states.

"PEDIGREE."

(Mr. Walter Miller, Peru, Indiana.)

Mr. Chairman, Ladies and Gentlemen: I have noticed on the program for this occasion that I have been given credit as hailing from Buenos Ayres. I presume Senator Wornall had something to do with it, but I hope that will not cast a reflection upon my being an American also, as I have a little patriotism and love of my country, and I am glad to say I am from Indiana.

First, I will give you an account of why I am here. Some days ago I met Senator Wornall in Chicago, and he seemed to insist that I consent to have my name placed on the program to give a little talk on some practical subject, and the "Senator" generally gets what he goes after—at least, he did in respect to the election—and I am very much in the position of the little darkey, I simply could not help it.

On the other hand, I feel, too, that I owe you an apology for having nerve enough to stand before you people and try to tell you something, realizing myself that I have so little ability in this regard. The other day I received a letter from the Secretary of your State Board of Agriculture that he considered it a special honor to be able to place my name on his program, and my father said, "What are you going to give them; I have not seen you making any preparations." And I told him something like this, that I did not want to speak a piece or read a paper, but I wanted to give some of the young men out here a few practical ideas. He said, "If you are not sure what you are doing, it looks like a good way to make a fool of yourself." (Applause.) So you see what some people are expecting, and for that reason I cannot help but feel that I owe you an apology for being here, especially to you older gentlemen, for I cannot hope to say much of any special interest to you, but the man I would like to give some good practical thought is the young man of my own generation, on the side lines here, and I hope they may be able to derive some benefit from what I have to say. And further than that, what I say I do not want to be taken in the way of advice; because of my short years and limited experience I cannot assume that position.

The subject I have been assigned, that of "Pedigree," is one of most vital importance in the breeding of the highest type of animal life, and it is most useful to the practical breeder of today. While I shall allow due credit to the value of pedigree, it shall be my intention, on the other hand, to show how little pedigree has to do with the success of a breeder. I mean to treat pedigree in its everyday application to successful breeding, and not from the standpoint of a connoisseur or student of fancy crosses.

First, what is the real meaning of "Pedigree?" We find in the dictionary and treatises on live stock that pedigree is simply a record of an animal's ancestors—in other words, a table of descent; and the early significance of pedigree was that the animal thereby represented was of some peculiar and distinct excellence, and unless the animal possessed some of these qualities, no record of him was preserved. In other words, it was the ancestry preserved by record of noted animals. The builders of breed foundation in those days were breeders in every sense of the word. They were men who believed in the fundamental law of nature, that "Like produces like," and that from good animals alone could they produce good animals.

Sometimes they knew absolutely nothing of the previous generations in an animal's history. Those were days when a pedigree would oftentimes consist of nothing more than a number in the record book—in the herd book governing the registration of animals of that breed of live stock—and in many instances I can refer you to certain sires in shorthorn history where they were not even given entry on their individuality, but years after, when these sires had proved themselves producers, they were then admitted into the herd book, and the only recommendation they had for their entry in the herd book was simply one of merit, not only of some individuality, but of breeding strength, and I think if that principle were applied today, we would have more high-class registered cattle and not so many registered scrubs.

Thus it is seen that in the beginning pedigree, preserved and valued, was an indication of excellence, but as time went on and these distinguished specimens of the different breeds passed from the hands of the originators into the hands of others less skillful perhaps, we find that they were subjected, more or less, to inferior principles of breeding and of handling, and these things have wrought great changes; so, generally speaking, the ones we own at present have withstood many destructive factors. Some have been neglected and declined from lack of food, exercise, air, etc., necessary to strong physical development; others have suffered from injudicious mating, and others from intentional inbreedings.

After these many years, it would seem that we have arrived at a point where pedigree is not a standard of excellence in the individual, and that is the thing I would like to emphasize. The only instance where pedigree can be considered a standard of excellence is where that pedigree has been for years a record of animals of extraordinary quality, and in these days, when cattle are bred so much for financial gain and animals are constantly changing owners, likewise conditions and principles in breeding and feeding, and it is practically impossible to find a pedigree which can be considered a real indication of individual merit.

No doubt some one would like to ask, what is the real value that should be placed on pedigree? Pedigree, without individual quality in the animal represented, is not worth the paper it is written on. Nevertheless, when representing a good animal, it is of great importance in reference to the various crosses therein, so inbreeding can be avoided, outcrossing procured, and a number of interesting facts learned in the history of the ancestry of the animal, and one of the most important of these is the breeders who have been the factors in the formation of this pedigree; because you all know that where one man may be doing something to improve a breed of some kind of live stock, there are ten men waiting to tear down what that one man may have done. So by having a pedigree we may be able to see and determine, by going into the herd book records, the sources of blood in the animal, the breeders who have appeared therein, and we know more or less perhaps of their methods of breeding and handling, and in this respect pedigree does undoubtedly add greatly to the value of an animal.

When we refer to the men who have done most to improve and establish a certain fixed type in the production of animal form, we should note that in most instances he is a man who has made a success of breeding by not giving special attention to pedigree. Referring to Amos Cruikshank, how was he in position to produce a strain of cattle with a type so fixed and qualities so excellent and make them stand today as they were in his own time? He was one of the greatest breeders who ever lived. It was simply because he paid no attention to pedigree, and selected his sires because of individual excellence alone. It is the only principle a man can safely follow, because the truest law we have in all nature is that "Like produces like;" by the use of good animals is the only way we can expect good offspring, and pedigree will have very little material influence.

And I will cite you to some cases where men have paid a great deal of attention to pedigree, and have become, in fact, what might be called pedigree cranks. I know of a number of cases where the result has been a dispersion. These men, who have followed pedigree too closely and have bred paper—in other words, looked more to the ancestry than the individual, have invariably come to financial disaster. The one door for all of them is failure at the finish, and their cattle, when sold, have some of them not even brought what they were worth for beef because of weak constitutions, tuberculous, and in such condition that a farmer would not want them among his cattle.

Fashions come and go in the breeding of live stock in pedigrees, the same as they come in dress and other things, but not quite so often; and the moment a man distinguishes himself as a producer of a peculiar type of animal, a type with some peculiar excellence, that man receives a reputation, and breeders fall over each other to buy his animals. And finally some other man, who has taken up this particular strain, turns to the breeding of cattle from this one herd as being favorable, and he no doubt in many cases is not a practical breeder and takes these animals from the standpoint of pedigree only, without regard whatever to the individual merit of the animal represented. Such men, ignoring absolutely this great law of nature, that "Like produces like," are the men who are doing the greatest damage to breeding interests today and who are forming the fashions. They are the men who tend to put questions into the heads of some prospective breeders as to what is pedigree and what importance should be accorded it in their selection of foundation animals.

Since heredity is the base of all breeding operations in the selection of foundation animals, attention should be paid, of course, to the sire and dam, and if convenient, to the grandsire and granddam, because it is the few top crosses in the pedigree that really influence the character of the offspring. Following the theory that something cannot come from nothing, I go so far as to say that one can make a successful breeder and leave pedigree absolutely alone in the selection of his foundation animals, and this is the encouragement I have to offer the young man considering the breeding of some particular line of live stock.

You should, and perhaps many of you do, aspire to taking up that sort of a line, and from the little attention you have given to the subject of pedigrees, you may wonder what is the fashionable pedigree which you should have in your foundation animals, but the advice, if I may be allowed to term it such, or rather the suggestion I would make, is that when you go out to select your animals you leave pedigree absolutely alone. When you go, go to a man of repute, a breeder who has made a success of the particular line of stock he may be handling. He has in his herd pedigrees of good quality. Breeders of repute would not have animals descending from questionable origin, and I would then place this definition on a pedigree: "Pedigree is absolutely nothing more or less—speaking of a good pedigree—than an extra individual and an honest breeder behind it."

Too many people allow the importance of the previous record of an imported dam in a pedigree to influence their selection of animals. For instance, take Young Mary in shorthorns. She was a great cow in her time and a cow that gave birth to seventeen calves, though the fact that Young Mary was a great cow ninety-five years ago would have absolutely no effect on the offspring of her family today.

Now, the thing I want to impress upon you, if I can, is that pedigree has very little to do with the success of a breeder. In starting out, if he will simply leave pedigree alone and trust the man of whom he is buying his animals, if the breeder is a man of repute, and the pedigree comes up to the requirements of the herd book register for the required number of generations, and all that —if he will simply select individuality and then apply the proper methods in the handling of these cattle, in their breeding and feeding, there is no question but that man will make a success; and by a success I mean a man who can take animals purchased from another breeder, and during the course of his possession of those animals improve on their quality, or, at least, maintain them at the same level, and the man who cannot do that is not doing much as a breeder. I hope some of you will take that one idea as to the real importance of pedigree—that it has very little to do with a breeder's success. (Applause.)

The Chairman: We would like to have this subject discussed by the breeders present. I would like to have Professor Mumford open the discussion on this subject.

Professor Mumford: I am surely very much interested in this particular subject, and am especially so because just day before yesterday, I think, this subject was up for discussion in one of our classes in animal breeding, and I was in the same unfortunate position that the gentleman seemed to think he was. I gave the class my ideas on the subject, but I am glad to say that my ideas at that time corresponded very closely to those of the experienced and distinguished gentleman who has just talked to you. Now, it is unfortunate that the idea of pedigree, in the minds of many farmers, has come to mean something of merit in itself. But, as Mr. Miller has just said, every animal has a pedigree, and every animal may have a written pedigree, and because an animal has a pedigree or because the ancestors of an animal are written in books, it does not necessarily follow at all that the animal is a good animal or has a good pedigree.

As I look at it, a pedigree, if of any value at all, is of value only in so far as the animals in that record are themselves good. We often hear in our discussions as to whether it is better to buy an animal with a good pedigree and not a good individual, or an animal that is a specially good individual but with a poor pedigree. That is perhaps one of the hardest questions that can be put. If left to me, I think I would say I would not take either one of them, because a poor individual with a supposedly good pedigree is a contradiction. Good pedigrees get good animals, and a good animal with a good pedigree gives us this assurance and gives us perhaps a truly valuable pedigree.

A good pedigree insures us, as well as it is possible for us to be insured, that the particularly good individual selected as a breeding animal has the ability to transmit his qualities to his offspring. And a good individual without a pedigree has not often that ability, and I am sure that all breeders will agree that the most important characteristic a good individual can possess is the ability to transmit those qualities which he possesses.

The Chairman: Let us hear from anyone else.

Mr. Gabbert: I would like to add a few words along that line. I don't know very much about it, but just because I know so little is the reason I am going to talk, too, perhaps. (Applause.)

Now this question has attracted many a man, and I must say more shorthorn men than advocates of any other breed. Some men will not buy an animal if it is not Scotch topped. Ever so good a one, with a common American pedigree, is not wanted. I have been breeding cattle for twenty-three years, and I never found a pedigree to represent very much.

Of course, a good pedigree is a pedigree that has an ancestry back of that pedigree that did something in the world, and naturally you would suppose that an animal would breed after its parents; you could not think otherwise. I believe strongly in heredity, and if it were not by that means we would not be able to tell more or less when two animals were likely to nick. That has more to do with breeding than anything else. I venture to say that no breeder with a promiscuous lot of cows, with various kinds of pedigrees, and all may be good individuals, and yet I dare say, with the best bulls he cannot produce good calves from that line of cows; for it is one of the well known facts in the history of animals that some two lines of breeding will nick and make good animals and some will not at all; and a breeder by pedigree does not find it out by that alone; he must do so by experience. I would advise any young breeder, if possible, to get a line of cows of one line or breed, and then try to find a sire that will nick with those cows, and to work along that line. This is the only line of success I know.

The Chairman: Let us hear from some one else on this subject.

Mr. Kidd—Mr. President: I wish to say a few words, not because I know so much, but because I have become enthusiastic. (Applause.)

In talking with Mr. Miller last night, after he told me his idea on this subject, I said, I believe you are right. And I do. Let us go back to Mr. Bates and Booth and the gentlemen who bred for individuality. I do not think their experience can be improved on by the present generation. So I think, if a breeder would start right now and let this popular line and fashion business alone, he would not only improve his breed, but make a greater success of the pure bred stock business, and he would help to make more young men successful, because they will naturally think in starting out what line had we best take up.

Often a sharper will say to a young man, "Here is an animal with pedigree which I would recommend to you," when it has absolutely no individuality. So it is with shorthorns at the present time—they are, I claim, not Scotch, but simply good animals, and so they were away back yonder when Amos Cruikshank bred them for individuality. We also notice in the show herds that occasionally a little Bates blood mixed in gives style and finish, because simply a few men have risked going out of the regular line and putting a little improvement in the points where they think their cattle are wanting.

So now, passing on down, for instance, to the different breeds of pure bred hogs: We have them sold in these sales and at the exhibitions at the present time, which is very detrimental to the different breeds, and a man will sell an animal for a fancy price, though he may not be a good individual, but sells high simply because he is sired by a certain other individual, when, as a matter of fact, the stock he was crossed on is bad, or the animals did not nick, and the buyer is disappointed simply because he bought him on pedigree. (Applause.)

The Chairman: Mr. Harned of Cooper county.

Mr. Harned—Mr. Chairman: Possibly, in the live stock breeding business, there is no other word in the whole vocabulary that is so often thought of and so full of interest, but I am sure there is no other word in the vocabulary of the live stock business as dangerous as pedigree. Pedigree is valuable, and I would not ignore its value, but it is strange the fault that gets into it. I am really surprised at the false ideas that get into as intelligent people as the American people in live stock breeding. It is strange that when we go to look at a pedigree we look at the bottom, instead of the top. We say an animal is a Young Mary; she should be a valuable article because in some way or other the descendants of Young Mary have been prepotent and transmitted their qualities. We have had a good example of this racket. Our friend, Mr. Kidd, referred to Mr. Bates. We have had a good example of this when we saw what a wreck this following pedigree too closely resulted in, and it was complete. If you keep in the old line you will see what you have got; you have simply a great big, long-legged, tuberculous nothing. Some men simply inbreed and inbreed—it is a disgrace. I am absolutely more ashamed of breeders on this thing of pedigree than of anything else.

They come into my county, and I advocate that we ought to combine pedigree and individual merit where it can be properly done. Of course, it takes some judgment to do that. The pedigree crank lives there in abundance, and if a new man comes in and one of these cranks gets hold of him, he says to him, "You ought to breed a single strain—the best is straight Bates or straight Cruikshank," and the fellow gets so bewildered he doesn't know whether he is in Cooper or some other county.

The fact of the business is, that there has been some wonderfully good things done by line breeding or inbreeding, but the amateur cannot do it. He must be a man of some experience and observation, and a good deal of perception to use line breeding to good advantage, and I would like to second the motion of Mr. Miller that when you start out to breed any kind of live stock you look to individual merit, and if you are not able to combine merit and pedigree in a way that will be of strength to you, you had better look simply to the animal and the honesty of the breeder and let pedigree go to the wind.

The trouble with pedigree is it never did make animals better. The pedigree was never intended to make animals better. It was nothing in the world but simply a speculative craze, and whenever you start a speculative craze on anything in the live stock business you can sure guess what the result will be. If a fellow is fool enough, I must say there are always some others who will work him. (Applause.)

Now, I have often thought of this thing at home, and from what I have heard I think it is a kind of a pet idea of some that wealth never stays in one family many generations. It seems strange that we harp on a family or on individuals that lived fifty years ago. I say families of cattle are valuable today for the merit they possess today, not for the merit they possessed fifty years ago. That is the standard of value in cattle. I admit I am very much interested in this subject. I had a good many thoughts when I was in my seat upon the subject, but it seems when I get up here my thoughts take a seat, and as they do not come in a regular way, I think I had better give it up. I thank you for your attention. (Applause.)

The Chairman: We will now hear from Mr. Halderman of Springfield on this subject.

Mr. Halderman: I want to second a good many things that have been said here. I think we are now striking the right line in breeding live stock, but I wish to say to these young men, do not throw your pedigree away entirely.

If an animal has not a strain back behind it, it may develop something you do not want. You may get an individual scrub animal much finer in general appearance than your pedigreed animal, but you don't know what may come out of that scrub.

To illustrate: Mary Ann of St. Lambert was a daughter of *Stoke Pogus* III, whose dam was *Old Margaret.* Stoke Pogus III was sold to the butcher before his get developed any form. Mr. Lambert took this strain and brought up what we call the St. Lambert strain.

There is another point. We want to know what we are going to breed for. If you want milk and butter, you want to look to that feature of the animal. You should look back behind the animal a little ways and see whether it has the power to produce in its posterity the qualities you want.

Mr. Miller is right in my judgment in regard to this thing of pedigree, but we do not want to throw pedigree away. A man must exercise his judgment and intelligence and breed pedigree to a certain extent, but he must watch the individuality. We are getting wild over strains. We must not be led off by strains unless they have the individuality.

The greatest cow on the Jersey side was Princess II, owned by Mrs. Shoemaker, and she made a test of her the first year and she tested forty-six pounds twelve ounces. They were feeding her all the feed she would bear; but one night they left a lot of feed in the barn, and she got loose and ate it and died.

Mary Ann of St. Lambert stood at the head of her breed with a record of thirty-six pounds. I once owned a cow that stood to compete with this strain. You might skim her milk and then let it set until it clabbered, and you could always skim off of it some new cream. My daughter says I am a crank on cream, and I am, and I think that is why I am seventy years old. I think that is the first and only cow I ever saw, but what I could stir her cream up and drink it, but I could not do her's that way, because it was too rich.

If you are trying for beef, breed for beef, and if you want milk breed for milk, but not for beef and milk at the same time, for you will make a failure of both.

The Chairman: We will hear Mr. Grooms.

Mr. Grooms: I would like to ask the question if it is not better to breed from an animal with a good pedigree than just because he has good looks?

The Chairman: I think that has been answered. It has been answered in your own minds, at any rate, and I think we all agree on that question, anyway, that a good animal, backed by good ancestors, is the one to breed.

ECONOMICAL RATIONS IN BEEF PRODUCTION.

(H. R. Smith, Bulletin No. 80, Nebraska Experiment Station.)

The discovery of methods by which beef production can be made more profitable is one of the important problems now under investigation at the Nebraska Experiment Station. During recent years the attractive prices offered for corn by the markets of the world have led many stockmen of the State to discontinue their cattle feeding operations and to sell the crop direct to elevator companies for shipment. Others have turned their attention to pork and mutton production. That beef values have not kept pace with those of corn in the upward trend of recent years is undeniable.

Nor can it be said that the market quotations for corn-fed beef have been as attractive as the prices offered for finished pork and mutton. Nevertheless, cattle feeding has its place, and the industry will be regarded with increasing favor as we learn to more fully appreciate the importance of cattle in their relation to the economic management of our land. On practically every farm in the State where grain crops have been grown and sold direct to the elevator for a succession of years, the soil is much below the productive capacity of adjoining farms where crop rotation and stock feeding have been practiced. Pork production, good so far as it goes in turning back to the land fertilizing material taken from the soil, and profitable as it has been during these years of high prices, should not be carried on to the entire exclusion of all other forms of meat production. The occasional destruction of an entire herd of swine by the ravages of cholera is a matter to be considered, but as an argument for a greater diversity of live stock on the farm it does not carry the weight of the one great argument, viz.: the economical conversion of the vast quantity of roughage grown on every farm as by-products to grain into some marketable commodity. Cattle and sheep feeding not only make possible the utilization of such material, but these ruminants, requiring much bulk as they do, also encourage the growth of more clover and alfalfa in the crop rotation, thus preserving the fertility of the land. Cattle are not only able to consume bulky material in quantity, but they are also able to take it in its crude form, less costly therefore than if labor is expended in its preparation.

During the years of low-priced corn cattle feeding was profitable under almost any system of feeding, but conditions have since changed, and methods must be varied to meet the new situation. n beef production, like other forms of industry, competition forces us to adopt more economical methods. Beef has always been a luxury, and we can hardly expect it to rise in value proportionate to that of corn and other cereals. When it becomes high in price, the consumers use less meat and more of other foods, which, though less palatable, can serve as substitutes. It is now up to the farmer to adopt more economical methods of production rather than to discontinue the feeding of cattle because of higher-priced grain. If cattle feeding, aside from its beneficial effect in maintaining or restoring soil fertility, is a profitable industry in more eastern states, as it still is when properly conducted, the farmers of Nebraska are situated to make it doubly so by virtue of the natural conditions which favor the industry here, viz.: lower-priced corn than any other state in the Union, the possibilities of alfalfa and clover culture, notably the former, favorable markets and shipping facilities, and a climate of relatively low humidity in winter which permits outdoor feeding. It would be unreasonable to expect cattle to return every year without fail prices for corn above what might have been received at the elevator. The instability of the average stock market would hardly permit it. But followed year after year, with careful buying, and the exercise of skill in the management of cattle, particularly with reference to the selection of foods, fair profits are to be depended upon.

Nebraska, relatively speaking, is a newly settled State, occupied for the most part by farmers who in the past have given most of their attention to the growing and selling of grain. It is not at all surprising, therefore, to find that as the need of stock on the farm is felt, mistakes will be made, and what might have been profits turned to losses. That the experiment station might be brought in closer touch with actual conditions as they exist in this State, the writer, in the early spring of 1903, visited a large number of feed-lots to learn what rations are in common use. In this investigation it was found that by far the largest number were fattening steers on corn and prairie hay, though some were making use of straw, cane or millet as a substitute for prairie hay. In the more central and western portions of the State corn and alfalfa were being fed, while a number in the Missouri river counties were feeding clover. The use of oil-meal and cottonseed-meal was confined to a few men who feed on an extensive scale and who buy practically all their grain. From the observations made, it would be conservative to say that unbalanced rations were being fed on two-thirds of the farms visited. That our farmers might have a practical demonstration of the greater possibilities of a system of cattle feeding which is in harmony with Nature's laws with respect to the character of the food as opposed to a system which ignores entirely the animal's physiological requirements, the series of experiments herein described were conducted under conditions precisely as they may be found on many farms in the State.

PLAN OF EXPERIMENTS, WITH REFERENCE TO CONDITIONS OTHER THAN FEED.

The steers selected for all experiments were grown under range conditions, having had no grain previous to their purchase. They were chosen for uniformity in age, quality and size as nearly as it was possible to secure it. When the division into lots of ten steers each was made, previous to the experimental feeding, an effort was put forth to make the several lots representative of the entire herd, so that no one lot would have the advantage of another in weight, quality, condition or age. This would make the several lots of a single winter's experiment comparable, but not those fed one winter with the lots fed another winter. In other words, the reader is not to compare the feed record of 1904-05 with the feed record of 1905-06, or any other year. Grade Hereford yearlings from Cherry county, Nebraska, were fed in 1903-04; grade Shorthorn two-year-olds from North Park, Colorado, in 1904-05; Grade Shorthorn and Hereford two-year-olds from Rock county, Nebraska, in 1905-06, and Grade Angus two-year-olds from Sioux county, Nebraska, in 1906-07. All lots in every experiment were provided with sheds having large open doors on the south side, to permit the steers to go in and out at will, none having horns. The yards were small but of sufficient size to permit of some exercise. All cattle were given water morning and night, and salt was kept before them at all times. Each lot was fed for a preliminary period of approximately three weeks before the records of the experiment were begun, in order that all steers might know how to eat grain, and furthermore, have time to gradually adapt themselves to their respective rations. The initial weights of the different lots as tabulated are an average of four weighings made on successive days just before watering in the morning. This is done to reduce as much as possible the element of error often caused by a fill larger one day than another. It is needless to say that every feed was carefully weighed, no credit being given for any coarse roughness left in racks and afterwards thrown out for bedding. This was charged to the steers just as though it had been consumed. From what has been said above, it may be assumed that the differences in gains as reported in the tables to follow are caused by the rations, at least as largely so as it was possible to make the several lots in a given experiment average uniform in quality and gaining capacity. It is out of the question to eliminate entirely the error which might be caused by individual differences in the gaining capacity of steers even by feeding in lots of ten each. It is for the purpose of making the conclusions more reliable that the same experiments are being continued through a succession of two or more years.

PRAIRIE HAY VS. ALFALFA.

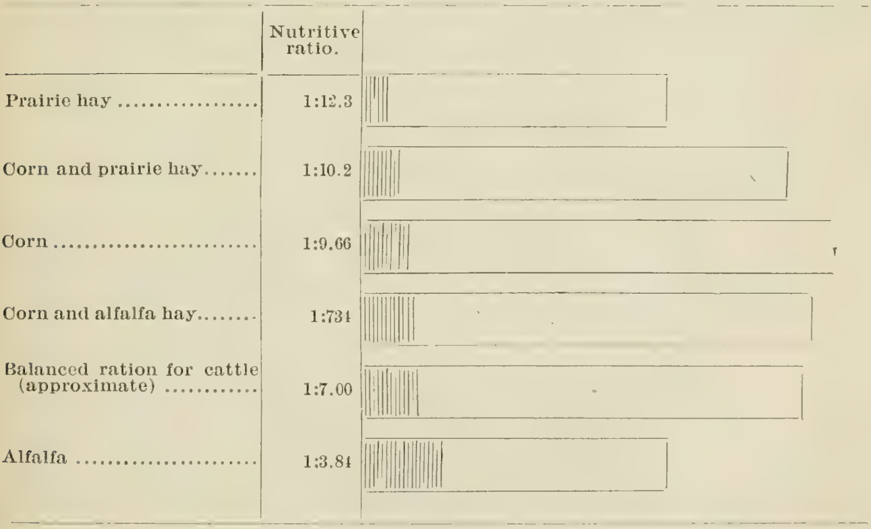
Following is a comparison of the relative value of native prairie hay as it grows in Nebraska and alfalfa, each being fed as a roughness to supplement heavy corn feeding:

CORN AND PRAIRIE HAY VS. CORN AND ALFALFA.

	Yearling steers Dec., '03, to June, '04, 24 weeks.		Two-year-old steers Jan., '05, to July, '05, 24 weeks.		Two-year-old steers Nov., '05, to Feb., '06, 12 weeks.		Average for 3 years.	
	Shelled corn and prairie hay.	Shelled corn and alfalfa.	Shelled corn and prairie hay.	Shelled corn and alfalfa.	*Snapped corn and prairie hay.	Snapped corn and alfalfa.	Corn and prairie hay.	Corn and alfalfa.
Average initial weight per steer, lbs.	801	808	926	937	975	977	901	907
Average gain per day, lbs.	1.35	1.97	1.90	2.30	1.20	2.06	1.48	2.11
Average grain fed per day, lbs.	14.30	15.30	17.90	18.60	9.47	9.47	13.89	14.46
Average hay fed per day, lbs.	8.70	9.20	9.70	9.20	18.22	22.15	12.21	13.52
Grain consumed per pound of gain, lbs.	10.50	7.70	9.52	8.14	7.87	4.60	9.29	6.81
Hay consumed per pound of gain, lbs.	6.50	4.70	5.19	4.02	15.16	10.75	8.95	6.49
Total food consumed per pound of gain, lbs.	17.00	12.40	14.71	12.16	23.03	15.35	18.25	13.30
Cost of 100 pounds gain	$8 27	$6 04	$8 23	$6 89	$8 76	$5 49	$8 32	$6 29
Net (profit or loss per head, including pork	Profit	Profit	Loss	Profit	Loss	Profit	Loss	Profit
produced from droppings.)	$.38	$8 66	$1 13	$2.86	$.08	$3.56	$.27	$5 02

*Snapped corn is the ear within the husk or shuck. The figures in the table are its shell corn equivalent.

It is never safe to accept as definite the conclusions drawn from a single experiment, but when we have, during a succession of three years, the marked contrast in daily gains, cost of production and net profits in favor of alfalfa, as compared with prairie hay, which the above table indicates, there would seem to be little room to doubt the superiority of alfalfa when each is fed with corn alone. There may be several reasons for this. Perhaps first in importance is the fact that alfalfa is a so-called legume, having, like clover and cowpeas, the power to take nitrogen from the air, storing it within its cellular structure in the form of proteids, which material is needed by the animal in the formation of lean tissue and bone. Alfalfa in itself contains more protein than the average fattening animal requires, an excess sufficient to compensate for that lacking in corn, the two together, therefore, making a balanced ration for fattening cattle. Prairie hay, like corn, lacks protein, and when fed singly or together, they do not supply enough of that nutrient to meet physiological requirements. This is best shown by examining the following chart, the black lines representing the digestible protein (lean formers) of each food and the white lines the digestible carbohydrates (starches, etc.) and vegetable oils, both of the latter forming animal fat and body heat.



What is approximately a well-balanced ration for the average two-year-old steer is indicated by the line having the nutritive ratio 1:7, by which is meant one pound of protein to seven pounds of carbohydrates and fats. It will be noted how closely the ration corn and alfalfa—two pounds of the former to one of the latter—approaches this proportion. In fact, we are not sure but that 1:7.3 is just as suitable as 1:7 for an average two-year-old steer. The corn and prairie hay combination, however, is decidedly lacking in protein, which is no doubt one of the chief causes of its failure as an economical ration. But the composition of a food is not the only factor which determines its value. Alfalfa is very much more relished than prairie hay and it is less difficult to masticate. Steers crowded for the largest possible consumption of grain can also be induced to eat a little more corn with alfalfa than with prairie hay.

In determining the cost of producing 100 pounds of gain, alfalfa and prairie hay were figured at $6.00 each per ton for the three years. Corn was 33 cents per bushel in 1903, 39 cents in 1904 and 35 cents in 1905. It is unfair to make comparative values on a roughage like alfalfa which balances well with corn alone and prairie hay which does not, but when thus fed, as in these three experiments, the alfalfa returned values ranging from $10.80 to $15.70 per ton, as compared with prairie hay at $6.00. The experiments show, however, that we can not afford to feed prairie hay at $6.00 per ton even if we include in the profits all pork made from droppings, as was done in these computations. At least we can not afford to do so if corn alone makes up the grain ration. Referring to the net profits per head as given in the table, it is of interest to know that the net advance of selling over cost price for the twenty-four weeks period was $1.30 per hundred on the corn and prairie hay steers in 1903, and $.78 in 1904, while the advance on the alfalfa steers was $1.65 per hundred in 1903 and $1.00 in 1904. The larger advance received for the alfalfa steers was due to the higher finish made by those steers. It is apparent that good profits can be made by feeding corn and alfalfa, even though the selling price of the cattle does not greatly exceed the cost price. In these experiments the feeding of alfalfa at $6.00 per ton with corn made this grain bring, when converted into beef, 51 cents per bushel in 1903, 44 cents in 1904 and 60 cents in 1905. It would take a larger advance than our markets afford to make corn and prairie hay profitable at existing prices for corn. Clover was not fed in this series of experiments, but because it is similar to alfalfa in composition, though somewhat lower in protein, it would not be unreasonable to expect good gains on corn and clover. Experiments made in other states show this to be true. With any other form of roughness with the exception of cowpea hay, which is also a legume, we would hardly expect satisfactory gains unless some protein concentrate is fed with corn.

THE USE OF CORN-STOVER WITH CORN AND ALFALFA.

From the experiments already described it is apparent that a ration of corn and alfalfa is capable of producing large and profitable gains, enough so to make corn bring more in the form of beef than as a cash crop. But with corn there is also the stalk upon which it grew. Do not these stalks, grown in such large quantity on our corn land, possess sufficient nutritive value to make it worth while to harvest them for feeding purposes? Left standing in the field they become woody, and are useful only as winter forage for stock cattle and horses, their value being estimated at from 25 cents to $1.00 per acre, a price not to exceed 50 cents per ton. When cut and put in shocks immediately after the corn ripens they remain fairly green, retain in the leaves the nutritive properties which they possessed when harvested, and are much relished even by cattle on a full grain feed. For the purpose of securing data upon the above question two experiments were conducted in which the ration corn and alfalfa was compared with corn, alfalfa and stover (stalks without the ears). The stover was fed unshredded in racks provided with vertical slats wide enough apart to permit the steers to enter their heads, thus preventing the stalks from being pulled out and trampled under foot. The coarse butts refused, approximately 40 per cent of the stalks fed were thrown out for bedding purposes, but charged to the steers as so much feed consumed. The stover was fed each morning in order that the steers might have the entire day to work over the stalks, and the alfalfa was all fed at night. Following is the record of the steers—ten two-year' olds in each lot—fed as indicated;

CORN AND ALFALFA VS. CORN, ALFALFA AND CORN-STOVER.

	Jan. 21, '05, to July 8, '05, 24 weeks.		Nov. 1,, '05 to Jan. 24, '06 12 weeks		Average 2 experiments	
	Shelled corn and alfalfa.	Shelled corn, alfalfa and corn-stover.	Snapped corn and alfalfa.	Snapped corn, alfalfa and corn-stover.	Corn and alfalfa.	Corn, alfalfa and corn-stover.
Average initial weight per steer, lbs.	937	941	977	974	957	957
Average gain per day, lbs.	2.3	2.4	2.06	1.96	2.18	2.18
Average grain fed per day, lbs.	18.6	18.4	9.47	9.61	14.03	14.00
Average roughness fed per day, lbs.	9.2	9.9	22.15	22.45	15.67	16.17
Grain consumed per pound of gain, lbs.	8.14	7.89	4.60	4.90	6.37	6.39
Roughness consumed per pound of gain, lbs.	4.02	4.56	10.75	11.44	7.38	8.00
Total food consumed per pound of gain, lbs.	12.16	12.45	15.35	16.34	13.75	14.39
Cost of 100 pounds of gain	$6 89	$6 49	$5 49	$5 01	$6 45	$6 05
Net profit per head, including pork	2 86	3 32	3 56	4 20	3 21	3 76

The table shows that in the first experiment equal parts of alfalfa and stover produced a slightly larger daily gain than alfalfa fed as the sole roughness with shelled corn. In the second experiment, when snapped corn was fed, the reverse was true. A ration consisting of corn and alfalfa is often too laxative, especially with the later cuttings of alfalfa. In the first experiment it is very probable that the stover lessened the tendency to scour, while in the second experiment the presence of husk and cob served the same purpose. There may have been also some advantage in having stover with alfalfa for variety. In this connection it may be said that prairie hay will answer the same purposes. In a 1905-06 test equal parts of alfalfa and prairie hay, with a light feed of snapped corn, gave an average daily gain of 2.01 pounds, compared with 1.96 pounds for stover and alfalfa, and 2.06 pounds for alfalfa. The prairie hay, however, cost as much as the alfalfa ($6.00 per ton), so there was nothing saved by using it. In both the experiments tabulated above, the use of corn-stover at $2.50 per ton as half the roughness reduced the cost of gains—in the first 40 cents per hundred, and in the second 48 cents. The stover proved to be actually worth $3.55 per ton with snapped corn and $4.16 per ton with shelled corn, worth 39 cents per bushel, as compared with alfalfa fed alone at $6.00 per ton. Nebraska produced last year, in round numbers, eight million tons of corn-stover. If one-half of this amount could have been converted into beef, bringing $2.50 per ton from the shock, instead of 50 cents in the stalk fields, eight millions of dollars could have been added to our earnings, and no losses from cornstalk disease would have come from feeding the stalks thus harvested.

FEEDING CORN FODDER (ENTIRE PLANT).

The objection that is usually raised against the practice of cutting and shocking corn for feeding purposes is the labor involved in husking it from the shock. The fact that a great deal of corn may be fed to cattle in the stalk unhusked is entirely overlooked. During the first part of the fattening period a large part of the corn may be fed in that manner. In a 1905-06 experiment one lot of ten two-year-old steers was fed corn fodder for a period of twelve weeks in comparison with the same amount of snapped corn and stover fed another lot. Two-thirds of all the corn given the one lot was attached to the stalk, the remainder consisting of shelled corn fed at night. Charging four cents per bushel for husking, the cost of gains was the same. In 1906-07 this comparison was again made, though half of the corn was then fed on the stalk. Here again the cost of production was practically the same, being only 10 cents per hundred less for snapped corn. The feeding of corn on the stalk in the morning with shelled corn and alfalfa hay at night has proven to be a very economical system of beef production. For such purposes corn which has been drilled a little thicker than usual is best, because the ears are somewhat smaller. It should not be planted so thick, however, that the yield of corn will be reduced. By feeding corn fodder we utilize the stalk, and at the same time are put to no extra labor husking it. In fact, corn can be cut with a harvester and put in the shock cheaper than it can be picked and cribbed. Three men with a team and harvester can cut and shock seven acres per day. Records from the Farm Department of this Experiment Station show that it costs $1.18 per acre to cut and shock corn, which figure does not allow for wear and tear on the machine. Three cents per bushel should cover the cost of harvesting the corn by that method.

THE USE OF LINSEED MEAL WITH CORN AND PRAIRIE HAY.

On many farms alfalfa or clover is not available in sufficient quantity to form even half of the roughness supplied fattening cattle. Under these circumstances the use of some commercial protein concentrate would seem desirable. In order that this might be given a practical test, three experiments were conducted in which the ration corn and prairie hay was fed with and without the protein concentrate linseed meal (oil-meal). The latter food was made but 10 per cent of the grain ration, because of its high protein content and relative cost. As in all experiments described in this bulletin, ten steers were fed in each lot:

CORN AND PRAIRIE HAY VS. CORN, LINSEED-MEAL AND PRAIRIE HAY.

	Dec., '03, to June, '04, 24 weeks.		Jan., '05, to July, '05, 24 weeks.		Feb., '06, to April '06, 8 weeks.		Average 3 experiments.	
	Shelled corn and prairie hay.	Shelled corn, oil-meal and prairie hay.	Shelled corn and prairie hay	Shelled corn, oil-meal and prairie hay.	Shelled corn and prairie hay.	Shelled corn, oil-meal and prairie hay.	Shelled corn and prairie hay	Shelled corn, oil-meal and prairie hay.
Average initial weight per steer, lbs.	801	799	926	934	1176	1187	967	973
Average gain per day, lbs.	1.35	1.91	1.9	2.1	1.27	2.52	1.51	2.18
Average grain fed per day, lbs.	14.3	15.4	17.9	19.4	19.1	24.6	17.1	19.8
Average hay fed per day, lbs.	8.7	8.8	9.7	9.5	5.5	6.8	7.9	8.4
Grain consumed per pound of gain, lbs.	10.5	8.1	9.52	9.06	15.10	9.77	11.71	8.98
Hay consumed per pound of gain, lbs.	6.5	4.6	5.19	4.30	3.94	2.70	5.21	3.87
Total food consumed per pound of gain, lbs.	17.0	12.7	14.71	13.36	19.04	12.47	18.92	12.84
Cost per 100 pounds of gain	$8 27	$6 82	$8 23	$8 27	$10 74	$7 87	$8 52	$7 61
	Profit	Profit	Loss	Profit	Loss	Profit	Loss	Profit
Net profit or loss per head, including pork	$.38	$4 76	$1 13	$1 09	$.46	$1 43	$.40	$2 43
Nutritive ratio	1:10.4	1:8	1:10.2	1:8	1:10	1:8	1:10.2	1:8

That linseed meal is capable of supplying what corn and prairie hay lacks is readily apparent when we note the marked increase in daily gains effected by its use. Each year the steers fed linseed meal took on a more thrifty appearance, as indicated by the coat of hair a few weeks after the experiments were begun. They ate their grain with greater relish, and when on full feed consumed somewhat more grain, which, of course, partly accounted for the increased gains. This was especially noticeable in the short period of heavy grain feeding in 1905-06, when the steers were crowded with grain throughout that entire period, the oil-meal steers taking 5.5 pounds of grain per day in excess of the lot not receiving it. However, in the two previous experiments, when both lots were purposely kept on the same amount of grain per day for the first three months, the linseed-meal steers, particularly the yearlings in 1903-04, gave much larger gains. It will be noted also that much less grain was required to make a pound of gain each year. the average for the three years being 23 per cent less. This is equivalent to saying that four pounds of corn with linseed-meal produced as much beef as five pounds without linseed-meal. With corn averaging 35.7 cents per bushel and linseed-meal $28.33 per ton for the three years, the cost of producing one pound of gain was 10.7 per cent less by the use of the linseed-meal. The experiments show the urgent need of some protein concentrate with corn and prairie hay, providing its cost is not too great. Had the average cost of the linseed-meal been $45.00 or more per ton for the three years, there would have been no advantage in using it.

PROTEIN CONCENTRATES COMPARED.

Having shown the importance of using with corn and prairie hay a small quantity of some protein concentrate, in this case linseed-meal, we next compare three protein foods, commonly sold in Nebraska, viz., wheat bran, linseed-meal and cottonseed-meal. Gluten feed, a by-product in the manufacture of starch, glucose, etc., from corn, would have been included in these tests if the cost of freight from eastern factories were not such as to make the price of this food prohibitive for stock feeding purposes here. Just as soon as starch and glucose are manufactured in quantity in this section, gluten feed will, no doubt, become a formidable competitor of the protein foods mentioned. Owing to the lower protein content of wheat bran, this food was made 25 per cent of the grain ration, whereas linseed-meal and cottonseed-meal were each made

10 per cent of the grain ration. It will be noted in the table to follow that the basic part of each ration in the first experiment was corn and prairie hay, while in the second it was corn and cornstover. Stover is even more deficient in protein than prairie hay, and a supplementary food rich in this nutrient is just as badly needed. In fact, one lot of steers on corn and stover in 1905-06 made an average gain of .2 pounds per day below the gains made by another lot on corn and prairie hay.

WHEAT BRAN VS. LINSEED-MEAL VS. COTTONSEED-MEAL.

	Feb., '06, to April, '06—8 weeks.			Nov., '06, to April, '07—20 weeks.		
	Corn 75% Bran 25% Praire hay.	Corn 90% Oil-meal 10% Prairie hay.	Corn 90% Cottonseed-meal 10% Prairie hay.	Corn 78% Bran 22% Corn-stover.	Corn 90% Oil-meal 10% Corn-stover.	Corn 90% Cottonseed-meal 10% Corn-stover.
Average initial weight per steer, lbs.	1146	1187	1154	973	976	988
Average gain per steer per day, lbs.	1.98	2.52	2.29	1.76	2.33	2.11
Grain consumed per steer per day, lbs	25.2	24.6	24.6	24.97	23.02	22.83
Average roughage consumed per steer per day, lbs.	5.5	6.8	6.2	8.91	8.96	8.89
Grain consumed per pound of gain, lbs.	12.97	9.77	10.77	14.19	9.88	10.83
Roughage consumed per pound of gain, lbs.	2.78	2.70	2.72	5.06	3.85	4.21
Total food consumed for 1 pound of gain, lbs.	15.75	12.47	13.49	19.25	13.73	15.04
Cost of 100 pounds of gain.	$9.31	$7.87	$8.59	$10.49	$7.64	$8.26
Value of pork produced as a by-product for 100 pounds of gain on steers.	$1.00	$ .84	$ .68	$2.30	$1.31	$1.68
Net cost of food per 100 pounds of gain.	$8.31	$7.03	$7.91	$8.19	$6.33	$6.58
Nutritive ratio by lots.	1:8	1:7.3	1:6.8	1:8.8	1:8.2	1:7.6

In both of these experiments bran gives a much smaller daily gain than either linseed or cottonseed-meal. In order to furnish the desired amount of protein, it was necessary to feed from five to six pounds per day to each steer, which quantity of this food, rather laxative in its effects, caused the steers to scour both winters. Several steers in the bran lot became more or less rheumatic or stiff. This was also observed both winters, but it was more pronounced in the second trial. No doubt, these difficulties were partly responsible for the unsatisfactory gains on corn and bran. No other lots were similarly affected, and it looks very much as if the bran caused it. The bran put on the market today is apparently less valuable than formerly, no doubt, because of its high crude fiber content, due to modern methods of milling, which effect a more complete extraction of the valuable portions of the wheat kernel.

While cottonseed-meal is slightly higher in protein than linseed-meal, the latter gave the larger gains in both these experiments, though the difference was not great. The cattle did not eat the mixture of corn and cottonseed-meal with the same relish that was conspicuous when the ration corn and linseed-meal was placed before them, and this, no doubt, furnishes one explanation of the superiority of linseed-meal in producing not only larger daily gains, but also larger gains from the same weight of food. The feeds used in the first experiment cost as follows: Corn, 35 cents per bushel; bran, $15.00 per ton, linseed-meal, $32.00 per ton, and cottonseed-meal, $32.00. Those used in the second experiment cost as follows: Corn, 36 cents per bushel; bran $18.00 per ton; linseed-meal, $29.50 per ton; cottonseed-meal, $27.75 per ton, and stover, $2.50 per ton. The prices given for commercial foods are on the basis of car lots delivered on track F. O. B. Lincoln. At the above prices it will be noted that the cost of producing one pound of gain was much greater with bran than either of the other foods. In the first experiment the linseed-meal proved to be three times as valuable as bran. The difference was even greater in the second experiment. It would not be wise, however, to place any relative values upon these foods until after further tests are made.

In examining the above table, it is interesting to note that the gains made in the second experiment where corn-stover was used as the roughness compared favorably with those made in the first experiment on prairie hay. We can not, however, formulate any estimate of the relative value of the two forms of roughness from the above table, because the first experiment was of only eight weeks' duration during the finishing period, while the second test lasted twenty weeks, practically the entire fattening period. Furthermore, grade Shorthorns were used in the first and grade Angus in the second experiment.

LINSEED-MEAL (A PROTEIN CONCENTRATE) COMPARED WITH ALFALFA (A PROTEIN ROUGHAGE).

The two experiments with protein concentrates conducted to date favor the use of linseed-meal as a food supplementary to corn when the roughness consists of either prairie hay or corn-stover. The question now arises, would it be possible to supply sufficient protein by making half of the roughness alfalfa, dispensing with the use of the concentrates, and still be able to secure just as satisfactory gains? This would make it possible to utilize a great deal of stover or prairie hay, and at the same time obviate the necessity of purchasing the commercial food. Two experiments in which the ration corn and linseed-meal was compared with corn without such a food when alfalfa forms half the roughness are here reported.

LINSEED MEAL vs. ALFALFA.

	Feb., '06, to April, '06—8 weeks.		Nov., '06, to April, '07—20 w'ks	
	Shelled corn, 90%,; linseed meal, 10%. Prairie hay.	Shelled corn, Alfalfa hay, 50%; Prairie hay, 50 %.	Corn, 90%; linseed meal, 10%, Corn-stover.	Corn, Alfalfa hay, 50%; corn stover, 50%.
Average initial weight per steer, lbs	1,187	1,164	976	978
Average gain per steer per day, lbs	2.52	2.29	2.33	2.42
Grain consumed per steer per day, lbs	24.6	23.2	23.02	22.33
Roughage consumed per steer per day, lbs	6.8	8.1	8.96	9.77
Grain consumed per pound of gain, lbs	9.77	10.16	9.88	9.22
Roughage consumed per pound of gain, lbs	2.70	3.55	3.85	4.03
Total food for 1 pound of gain, lbs	12.47	13.71	13.73	13.25
Cost of 100 pounds of gain	$7.87	$7.40	$7.64	$6.99
Value of pork produced as a by-product for 100 pounds of gain on steers	$ .84	$1.07	$1.31	$1.53
Net cost of food per 100 pounds gain	$7.03	$6.33	$6.33	$5.46
Profit per head, including pork produced from droppings	$1.43	$2.53	$1.65	$6.38
Nutritive ratio	1:7.3	1:8.7	1:8.2	1:8.7

In the matter of daily gains, the linseed-meal seems to have the advantage in the first experiment with prairie hay, and the alfalfa in the second experiment with corn-stover. An average gain of two pounds per day for an entire fattening period is ordinarily considered good. The gains made on both rations in the two experiments reported are, therefore, very gratifying, particularly the average gains made for a period of twenty weeks in the second experiment. The fact that one lot of ten two-year-old steers gained 2.33 pounds each per day for a period of five months with unshredded corn-stover for roughness and no hay of any kind is added proof of the high feeding value of this by-product, so commonly wasted in Nebraska.

While the linseed-meal ration shows its superiority over the alfalfa combination in making larger daily gains during one experiment, the use of alfalfa without linseed-meal made the gains less costly in both. The alfalfa fed steers in the first experiment sold for the same price per hundred as the linseed-meal steers. In the second experiment the alfalfa steers sold for $5.65 per hundred, while the linseed-meal steers sold for $5.50 the same day.

With corn costing 35 cents per bushel and prairie hay $6.00 per ton, the alfalfa hay proved to be worth $13.11 per ton in comparison with linseed-meal costing $32.00 per ton. In the second experiment with corn worth 36 cents per bushel and stover valued at $2.50 per ton, the alfalfa returned a value of $13.12 per ton in comparison with linseed-meal at $29.50. From these figures it is apparent that alfalfa possesses a high value as a source of protein. The experiments, furthermore, suggest that a relatively small quantity of this hay will supply sufficient protein to insure good gains on two-year-old steers, and that this can be produced on the farm much cheaper than it can be purchased on the market in the form of linseed-meal or some other protein concentrate.

PRAIRIE HAY AND CORN-STOVER COMPARED.

In the comparison of linseed-meal and alfalfa, first when used with corn and prairie hay, and second with corn and stover, the reader is not to draw any conclusions as to the relative value of prairie hay and stover, because they were fed during different years under dissimilar conditions. Following is a direct comparison of these two hay plants, one year with linseed-meal supplementing the corn, another year with alfalfa forming half the roughness with each, and a third comparison with each roughness fed with corn alone:

PRAIRIE HAY vs. CORN-STOVER.

	Dec., '03, to June, '04—24. weeks.		Nov., '05, to Jan., '06— 12 weeks.		Nov., '05, to Jan., '06—12 weeks.	
	Corn 90% Oil-meal 10% Prairie hay.	Corn 90% Oil-meal 10% Corn-stover.	Snapped corn, Prairie hay and Alfalfa.	Snapped corn, Corn-stover and Alfalfa.	Snapped corn and Prairie hay.	Snapped corn and Corn-stover.
Average initial weight per steer, lbs.	799	777	979	974	975	976
Average gain per steer per day, lbs.	1.91	1.96	2.01	1.96	1.20	1.02
Average grain consumed per steer per day, lbs.	15.4	15.6	9.47	9.61	9.47	9.47
Roughage consumed per steer per day, lbs.	8.8	11.2	21.10	22.45	18.22	22.86
Grain consumed per pound of gain, lbs.	8.1	8.0	4.70	4.90	7.87	9.25
Roughage consumed per pound of gain, lbs.	4.6	5.7	10.47	11.44	15.16	22.44
Total food consumed per pound of gain, lbs.	12.7	13.7	15.17	16.34	23.63	31.69
Cost of food for 100 pounds of gain	$6.82	$6.09	$5.47	$5.01	$8.76	$8.11
Nutritive ratio	1:8	1:8.3	1:7.2	1:7.3	1:11	1:13.1

When balanced rations were fed, the protein being furnished in one experiment by the use of linseed-meal and in the other by alfalfa hay, the corn-stover made a favorable showing with prairie hay, proving to be worth, in the first, $4.23 per ton, and in the second, $5.17 per ton, compared with prairie hay at $6.00 per ton. In the third comparison, without a protein food, the stover returned a value of but $2.77, compared with prairie hay at $6.00. This is, perhaps, attributable to the lower protein content of stover. As already stated, not more than 60 per cent of the stover charged to the steers fed in those experiments was consumed, the remainder consisting of refuse butts, which had to be thrown out for bedding. The stover actually consumed would seem to possess a feeding value quite the equal of prairie hay. Inasmuch as corn-stover contains only 60 per cent dry matter, while prairie hay is approximately 90 per cent, it would seem conservative to say also that the dry matter of the entire cornstalk, with ear detached, cut immediately after the corn ripens and properly cured in the shock, is equal to the dry matter of prairie hay.

THE RELATIVE ECONOMY OF A HEAVY AND LIGHT RATION OF CORN.

The experiments so far conducted and reported in these pages indicate that beef can be produced most economically in Nebraska by the use of corn, alfalfa and corn-stover. It would seem proper to next determine, if possible, what proportion of corn to such roughness is most economical. Corn has ruled high in price during the past few years, while roughness of all kinds has remained relatively low in value until the last year, when hay has been abnormally high, because the dry weather which prevailed throughout the country during the early part of the summer caused a shortage in this crop, the effect of which will, no doubt, be but temporary. The cost of hauling and shipping hay and other bulky feed is such as to make it seem probable that the price of roughness on our Nebraska farms, many of them situated some distance from stations, will not advance with corn in the future. Beef cattle in the west are ordinarily fed all the grain they will consume, very commonly by the use of self-feeders, having before them what rough feed is needed to satisfy the craving for bulk. The latter is often of very inferior quality, perhaps a stack of wheat straw, and a very limited quantity is consumed. That a good quality of roughness can be made to take the place of a part of the corn is shown by the following single experiment conducted the past winter:

HEAVY VS. LIGHT FEED OF CORN WITH ALFALFA AND CORN -STOVER.

	Nov., '06, to April, '07— 20 weeks. Corn (heavy feed) Alfalfa hay, 50% Corn-stover, 50%.	Nov.,'06, to May,'07,— 24 weeks. Corn (light feed) Alfalfa hay, 60 % Corn-stover, 40%.
Average weight per steer Nov. 14, lbs.	978	977
Average gain per steer, 5 months for lot 4, 6 months for lot 5, lbs..................	339	339
Average gain per steer per day, lbs...........	2.42	2.01
Average grain consumed per steer per day, lbs.	22.33	13.89
Av. roughage consumed per steer per day, lbs.	9.77	18.08
Av. grain consumed for each lb. of gain, lbs. ..	9.22	6.91
Av. roughage consumed for each lb. of gain, lbs	4.03	8.96
Average cost of 100 lbs. of gain, cents.........	$6 99	$7 06
Value of pork produced as a by-product for 100 lbs. of gain on steers................	1 53	1 44
Net cost of food per 100 lbs gain	5 46	5 62
Profit or loss per head, including pork produced from droppings	6 38	4 61
Nutritive ratio	1:8.7	1:7.3

The steers on the light ration of corn were never given to exceed fourteen pounds of corn per day, the average daily ration for the twenty-four weeks being 13.89 pounds, while the full-fed steers were given as high as 24 pounds per day, an average of 22.33 pounds for the period of twenty weeks fed. The light fed steers consumed as much more roughness as the heavy fed steers consumed more corn.

It is interesting to note that the ten steers on the light grain ration made the same gain in six months (24 weeks) that the heavy fed steers made in five months (20 weeks). The light fed steers were equally well finished with the extra month's feeding and sold at $5.50 per hundred, the top of the South Omaha market, May 14, 1907, when there was a heavy run of cattle. The heavy fed cattle sold for $5.65 April 16th, one month previous, when the market was 20 cents per hundred higher, as found by averaging the selling price of the top hundred steers April 16th, and the same number May 14th. In computing the net profits in the above table, both lots were figured at $5.38 per hundred net, the price received for the heavy fed cattle on home weights at the close of the experiment. At last winter's (1906-07) prices on feeds, viz., shelled corn 36 cents per bushel, snapped corn 35 cents, alfalfa hay $8.00 per ton, and stover $2.50 per ton, the heavy fed steers produced gains at a net cost (deducting pork from droppings) of $5.46 per hundred, compared with $5.62 for the light fed steers. Had the alfalfa hay cost $5.00 per ton instead of $8.00—and alfalfa in the stack on the average farm of Nebraska does not usually command a figure greater than that—the net profits per steer would have been the same in both lots. This would have been true also if the corn had cost 50 cents per bushel instead of 35 cents, figuring the alfalfa at $8.00. This experiment emphasizes further the value of alfalfa as a beef producer, and it opens a new and important field for future investigations. The record made by the light fed cattle was no accident, as another lot in a corn fodder experiment made very nearly as large gains on the same grain ration. No conclusions, however, are to be drawn until after further tests along this line are made. As a single experiment, it suggests the possibility of producing beef most economically on what approaches a full grain feed when corn is low in price and alfalfa high. When corn is high and alfalfa low, something more like half a full feed of grain would make beef production more profitable, even though more time is required to finish the cattle. Judging from the results of the above experiment, it is probable that the most economical proportion of grain to hay under varying conditions will be found somewhere between a half feed and a full feed of grain, nothing definite being known until after several tests are made in which different quantities of grain are fed.

CONCLUSIONS FROM THESE EXPERIMENTS.

1. Prairie hay, when fed with corn alone to fattening cattle, gives small and unsatisfactory gains, and very little or no profit.

2. Alfalfa hay, with corn alone, gives large and profitable gains.

3. The use of well-cured corn-stover with alfalfa and corn, while it may not produce larger gains, will make the gains less costly, because of its low market value, thereby increasing the profits over corn and alfalfa alone.

4. In feeding only prairie hay, as roughness to fattening cattle, much larger and more profitable gains can be made if linseed-meal or possibly some other protein concentrate is fed with corn in small quantity, rather than feed corn alone.

5. The results of two experiments indicate that linseed-meal is a little more valuable than cottonseed-meal, and much more valuable than wheat bran for supplementing corn when fed with prairie hay or corn-stover.

6. When alfalfa is made at least half of the roughness with prairie hay or corn-stover good gains may be made, and at less cost than when no alfalfa is fed, the protein being supplied by the

use of linseed-meal. In other words, it is possible to grow protein on the farm at a price much below what it will cost on the market in form of some commercial protein food.

7. Corn-stover cut immediately after the ears ripen and cured in shocks possesses a value fully two-thirds as great as prairie hay. The part usually consumed, viz., the leaves and upper portion of stalk, is quite the equal of prairie hay pound for pound.

8. The results of a single experiment, in which but little more than half a full feed of corn was supplied two lots of fattening steers, suggest the possibility of making larger use of hay in finishing cattle for market than is ordinarily made and at less cost, especially where hay is relatively low and corn high in price.

PROFITABLE MUTTON PRODUCTION.

(F. B. Mumford, Professor Animal Husbandry, Missouri Agricultural College, Columbia, Mo.)

Mr. Chairman, Gentlemen of the Convention—Whatever other good things the experiment stations have helped to do in connection with agriculture and agricultural operations, they have certainly contributed greatly to the definiteness of the operations which are conducted under the name of agriculture.

We talk of beef production and pork production and mutton production now in terms of some understanding. We know within certain narrow limits about how much corn, for example, is required to produce a pound of beef. We know that when under certain conditions we feed a given amount of corn to hogs we secure a certain amount of pork, and this is one of the most important results achieved. I am sure this idea has impressed itself on your minds in listening to the papers and addresses that have been delivered before you.

It is not my intention to burden you with a long address nor undertake to cover the smaller points of the subject which has been assigned to me, but I shall, owing to the shortness of the time and the magnitude of the subject, refer to only a few of the points I had intended to speak about, and will try to make them as clear and brief as possible.

I take it that the fundamental problem in all our agricultural operations is to try to get the largest net profit per acre, combining therewith the idea, which we heard so ably discussed this morning, of permanency. Profitable and permanent farming must go together.

We have also heard already in this convention that profitable and permanent agriculture involves necessarily the handling of live stock. It is not possible in the middle west for us to conceive of any other kind of successful farming than live stock farming. This places the farmers in a class above mere producers of raw material. The farmer produces raw material, it is true, but if necessary that we must change those raw materials into the finished product, we must, like the manufacturer, use machines, and in this conection I like to think of the animal as a machine to be used in the manufacturing of the raw products—corn, hay, grass and grains of the farm—into the finished products—beef, pork and mutton—and as the efficiency of the machine, in the case of the manufacturer, frequently determines the profit he is to receive from his manufacturing operations, so the efficiency of the animal machine will often, or generally, perhaps, determine the net profit of the farmer per acre of land.

This organization, the Missouri Improved Live Stock Breeders' Association, is founded upon the idea that it is possible to produce efficient animal machines, and the improvement of these machines is the primary object of the Improved Live Stock Breeders' Association. It needs no argument at this time to convince breeders of improved live stock that there is a difference in animal machines. It is not necessary for me to call your attention to the fact that one horse will eat a bushel of oats, and when hitched to a sulky and driven by an experienced driver will trot a mile in two minutes, while another horse will eat a similar quantity and quality of oats, and when hitched to the same sulky and driven by the same experienced driver, will do very well if he is driven a mile in six minutes. The difference is not in the oats, or the sulky, or the driver, but it is altogether in the efficiency of the animal machine. One horse eats a bushel of oats and obtains therefrom energy to trot a mile in two minutes; another can only secure sufficient energy to trot a mile in six minutes. Some cows eat a certain amount of feed and produce 125 pounds of butter in a year. Other cows will eat the same amount of feed and will make 300 pounds of butter a year. There is no difference in any of the conditions except in the efficiency of the animal machine. So I might go on and show that the profit secured in our live stock operations lies in the fundamental question of selecting the best animal machines. There is not only a difference of individuals in the same breed and class of animals, but there is a very wide difference between the different classes of animals. That is, there is a very wide difference between pork-producing machines and beef-producing machines; and similarly a wide difference in the ability of the beef animal to make a pound of beef from the corn fed as compared with the mutton animal. There is likewise a very wide difference between the ability of the beef animal to make a pound of beef and of the hog to make a pound of pork from the same amount of feed; and between the hog to make a pound of pork and the mutton animal to make a pound of mutton.

I have, with the assistance of one of my graduate students (Mr. C. G. Starr) in animal husbandry, studied the actual amounts of grain required to make a pound of beef or a pound of pork or a pound of mutton, under the conditions existing in the middle west. That is to say, the problem of feeding is this: To feed the raw products which we produce on the farm long enough and in the right way, so the animals to which it is fed will in time become fat or finished—and the best and cheapest way to accomplish this result. Of course, we must feed them until they arrive at a certain degree of fatness. With cattle this time varies from three to six and even twelve months. In the case of hogs, this time is still more variable. In the case of mutton sheep, I suppose the average time for finishing a sheep in the winter season is about three months, this being more or less dependent upon the condition of the sheep at the beginning of their feeding.

The experiment stations of the United States have conducted hundreds of experiments in cattle feeding, hog feeding and sheep feeding, and have, as a result of this large amount of work, arrived at certain conclusions as to the amount of feed required to produce these different kinds of meat, and in a chart which I shall show you I have tried to collect the statistics as they are shown by these experiments, comparing the cost of feed in producing beef, pork and mutton:

TABLE I—GRAIN REQUIRED FOR 100 POUNDS GAIN—DRY LOT.

RATION	CATTLE		HOGS	SHEEP	
	Grain	Hay	Grain	Grain	Hay
	Pounds	Pounds	Pounds	Pounds	Pounds
Corn	1080	457	500	420	458
Oats	....	...	421	331	595
Barley	914	...	446	305	...
Peas	...	...	452	549	Pastured
Varied (with roots or silage)	712	572	359	370	382
Varied	953	292	431	326	422
	914	440	435	383	464

Manifestly, in comparing the cost of beef production with the cost of pork production, it would not be fair to compare a steer three years old with a pig weighing fifty pounds, fed on a mixed or balanced ration, while the steer has not been so fed; and on the other hand, it would not be fair to compare a calf fed on a well balanced ration to a hog fed on corn alone; and in order to make this comparison more accurate, we selected all the feeding experiments we could find that had to do with feeding corn to cattle—mostly two-year-old cattle—and we took the experiments of the Missouri, Kansas, Illinois, Iowa and other experiment stations that have ever fed corn as a sole grain ration to cattle, hogs and sheep, and as a result of the average of all those experiments concerned with feeding corn to cattle, hogs and sheep, we found these facts: It required on an average 1,080 pounds of corn to make 100 pounds of gain, in the case of cattle, and 457 pounds of hay fed with the grain. The kind of hay fed was variable. In some experiments clover hay was used, and in some timonthy and in some trials other roughages. In the case of hogs fed on corn alone, we found the average amount of feed per one hundred pounds of gain was 500 pounds. In the case of sheep, there are included the experiments conducted at the Michigan Station, the Wisconsin Station, the Minnesota and other stations—six or eight different stations in all—and in these experiments it required 420 pounds of corn to make 100 pounds of gain with 458 pounds of hay. In other words, it required the same amount of hay as with cattle, but it required only one-half as much corn to make a pound of pork or mutton as to make a pound of beef.

But we did not stop with corn alone. We compared the same class of animals fed on oats, barley and on varied rations, mostly balanced rations, with the addition of roots and silage, and on balanced rations without the addition of roots and silage. We found oats were used only for fattening hogs and sheep, and it required 421 pounds of oats where they had been fed. When barley was fed to two-year-old cattle 914 pounds were required to produce 100 pounds of gain. Barley fed to sheep required 305 pounds of grain feed per 100 pounds gain. There were three or four experiments only in feeding barley to sheep.

In feeding peas, we were able to find only one Canadian experiment, which shows that it required 452 pounds of peas to make 100 pounds of pork, and 549 pounds to make 100 pounds of mutton. But this experiment with sheep in connection with grazing the peas was on the ground, and this comparison is not, therefore, of great value. The feeding of mixed or balanced grain rations comprised more work than all the others combined. When mixed rations, mostly balanced rations, were fed in connection with roots or silage, it required 712 pounds of grain to make 100 pounds of gain with cattle. With hogs it required only 359 pounds of grain to 100 pounds of gain, and with sheep it required 370 pounds grain to 100 pounds of gain. The cattle required 572 pounds of hay and the sheep 382 pounds. When the same kind of rations were fed, with the addition of roots and silage, the average is 914 pounds of grain per 100 pounds gain for the cattle, 435 pounds for the hogs and 383 pounds for the sheep.

Now, we were considerably surprised at the results of our investigations, and so much so that we went over the matter a second time, in order to get at the truth of this matter; but so far as I am able to compare the information gained, this is a fairly accurate comparison. Now some one may offer the suggestion immediately that we do not know how old these animals were, which is true. As it happens, however, most of the cattle fed were two years old, and most of the sheep fed were lambs, and most of the hogs fed were hogs under 200 pounds. The hogs and sheep were comparatively younger than the cattle; but in answer to that it may be said that this represents the actual conditions. The greatest amount of mutton produced in the United States is produced from feeding lambs, and the greatest amount of beef from feeding two-year-old cattle, and the figures represent fairly the average kind of hogs fed. So these figures are comparable as representing the particular kinds of animal machines that are used to make over the products of the farm into the finished product:

TABLE II—YOUNG ANIMALS—GRAIN REQUIRED FOR 100 POUNDS GAIN—ALL RECEIVED SKIM MILK.

CALVES	PIGS	LAMBS
432 lbs.	320 lbs.	284 lbs.

The above table (II) illustrates the relative efficiency of cattle, sheep and hogs of similar ages. It must be said, however, that the number of experiments on this point are limited, and I do not, therefore, place the same weight upon this table that I do upon the results in table I.

It is then a comparison between calves, pigs and lambs. The Iowa Experiment Station found that calves fed on skim milk required 432 pounds of grain on the average for 100 pounds gain, the larger part of the ration being shelled corn. At the Wisconsin Station, pigs and lambs fed on skim milk with grain required for the pigs 320 pounds of grain to make 100 pounds of gain, and the lambs only 224 pounds. So when we compare the youngest animals fed for beef, pork and mutton, the sheep compare very favorably with the others.

TABLE III—GRAIN REQUIRED FOR 100 POUNDS GAIN ON PASTURE.

CATTLE	HOGS	SHEEP
830 lbs.	398 lbs.	245 lbs.

Under pasture conditions (see table III), we also have a few experiments in which they were fed grain while on pasture. The Missouri experiment required 830 pounds of grain to 100 pounds of gain in the case of cattle; 398 pounds (several stations) in case of hogs, and 245 pounds (Iowa) in case of sheep.

I have made no mention of hogs following cattle, but that is not always stated in the experimental results, but on the average I suppose where 1,080 pounds of corn is required to make 100 pounds of beef, we ought to reduce it on this account to about 800 pounds, and where 912 pounds is fed, we ought to reduce it to, say, about 725 pounds of grain to make 100 pounds gain—that is, subtracting the amount of corn that may be utilized for the production of pork.

I shall, of course, eliminate all I intended to say about sheep breeding. That subject has been very well covered by the gentlemen who have already discussed it, and I shall confine myself exclusively to the discussion of three or four methods of fattening sheep.

I shall have to assume, in the first place, that I am talking to sheep feeders, and shall not stop to consider methods of handling sheep in general, but only the feeding of some rations that have been used with great profit in the production of mutton. These facts which I shall present to you are the results of my own experiments, and I give them to you because I know more about them and am better acquainted with all the conditions surrounding these particular feeding tests.

One thing is certainly established in my mind regarding feeding sheep, and that is, it is easily possible to keep them too warm. We have demonstrated to my satisfaction that particularly fattening sheep are nearly always kept too warm if confined in warm shelters. Our experiments have demonstrated conclusively that the best possible shelter for sheep is a dry place—under an open shed, but not in a warm barn; and this is true notwithstanding what we have learned about saving feed by keeping animals warm. These tests have shown that it will take as much or more grain to make a pound of gain when sheep are confined in a warm barn than if fed in an open shed. This is particularly true of this part of the country. It is also true as far north as Michigan.

I cannot stop to talk of the different rations that have been fed, but I will try to call to your attention a few rations that have proven to be good rations for fattening sheep. Corn and clover hay have proven during the series of four or five years not only the best ration, but the most profitable ration in most cases. While this ration may not always produce the highest gains, still, corn and clover hay have in our experiments in feeding lambs, as compared with what we call a balanced ration, produced equally good results, and during the four or five years' work corn and clover hay has been a more profitable ration than corn mixed with linseed meal or other supplements that have been tried.

The question has often been asked, "Does it pay to shear sheep before feeding them." It is the custom in some parts of the country to shear the lambs in the fall before beginning to feed, and one year at the Michigan Experiment Station the lambs were shorn in the latter part of November. They were placed in a warm barn, kept closed and as warm as possible. Another lot of sheep fed exactly the same way, with the wool left on, was fed in a barn with all the doors left open. The results were all in favor of the unshorn lot fed in a dry but not warm barn.

The following tables give the results of various station tests in fattening sheep:

TABLE IV.

10 lambs in each lot. Fodder ration, clover hay.

No of lot........	Distinguishing rations.	Total grain—lbs	Total hay—lbs..	Roots, rutabagas—lbs.......	Total gain—lbs.	Average weekly gain—lbs	Cost of 1 pound gain—cents...	Dry matter for 1 pound gain—lbs............
1	Corn (shelled)	1757	1675	1190	443	2.6	4.5	6.95
2	Oats	1963	1694	1190	379	2.2	7.1	8.68
3	Bran	1779	1728	1190	242	1.4	8.25	12.9
4	Corn ½, oats ½ (weight)	1735	1711	1190	436	2.6	5.1	7.11
5	Corn ½, bran ½. "	1973	1698	1190	358	2.1	6.0	9.14
6	Oats ½. bran ½. "	1957	1722	1190	361	2.1	6.7	9.13
7	Corn ⅓, oats ⅓, bran ⅓ (weight)	1968	1654	1190	387	2.3	5.8	8.37
8	Roots (rutabagas)	1173	1220	6706	393	1.7	7.7	9.28
9	Silage	1173	987	4504*	381	1.7	6.3	10.01
10	"Self feed", corn ⅓, oats ⅓, bran ⅓	2120	528	1360	260	2.17	8.0	9.45
11	Corn	1579	1097	......	328	2.18	4.6	7.02
12	Corn and roots	1612	964	2720	397	2.64	4.6	6.41
13	Corn 6 6-7, linseed meal 1 1-7, and roots	1716	967	2675	392	2.61	5.3	6.72
14	Corn 6-7, linseed meal 1-7	1735	1158	......	357	2.38	5.1	6.99
15	Corn ½, bran ½	1703	1124	......	267	1.78	6.0	9.15
16	Wheat ½, and corn ½	1485	1118	......	295	1.97	5.4	7.64
17	Wheat 6-7, and linseed meal 1-7	1530	1147	......	291	1.94	6.3	8.04
18	Corn (self feed)	1506	961	......	248	1.65	5.5	8.57
19	Corn ½, and bran ½ (self feed)	1838	959	......	237	1.58	6.8	10.03
20	Corn ½, and wheat ½ (outdoors)	1196	1087	......	205	1.57	6.8	9.65
21	Corn ½, and wheat ½ (indoors)	1164	1173	......	230	1.77	6.1	8.77
22	Corn	1208	1142	......	233	1.80	5.4	8.12
23	Wheat	1201	1199	......	217	1.67	7.5	9.56
24	Corn ½, and wheat ½ (lambs sheared Dec. 1)	1263	1336	......	161	1.24	9.9	13.97
25	Sugar beets	5685†	1181	......	116	.89	9.7	15.60
26	Corn, wheat, oats and brañ (self feed)	1460	924	......	206	1.58	7.6	10.04
27	Corn ½, and wheat ½	1232	1209	......	249	1.91	5.9	8.48

*Silage.
†Sugar beets.

Values used in computing cost of gain:

Corn..........$0.40 per bushel.
Oats .... 0.32 " "
Wheat ...... 0.60 " "
Oil meal....$25.00 per ton.
Bran .... 14.00 "
Roots........ 2.50 "
Silage .... 2.50 "
Clover hay.. 7.00 "

CONCLUSIONS.

1. Lots receiving corn in the fattening ration, either in whole or in part produced the best gains, were apparently in better finish, and in general were fed at a greater profit than the lots fed any other ration. (See lots 1, 4, 5, 10, 11, 14, 22, etc.)

2. A grain ration made up exclusively of wheat bran proved to be inferior for fattening lambs. (See lot 3.)

3. Feeding by means of a "self feed" is an expensive method of fattening, and is not to be recommended either from the standpoint of total gains made or the amount of dry matter required to produce a given gain. (Compare lots 7 and 10, 11 and 18; 15 and 19, and 21 and 26.)

4. Wheat bran is more valuable, pound for pound, than corn, and hence can be fed profitably in this State, except when it approaches very closely the value of corn.

5. When roots are fed in a ration better gains are made and less dry matter is required to produce one pound of gain.

6. Shearing lambs late (March 8) in winter during feeding period increases the rate of gain.

7. Shearing in fall (December 1), was not followed by good results, and in these experiments was not as profitable as feeding unshorn lambs. (Compare lots 21 and 24).

8. The animals, fattened on rape during the fall and in good condition at the beginning of the experiment were essentially as successful feeders as those in poorer condition that were pastured on grass during the same fall period. (Compare lots 21 and 27.)

9. Small gains are not necessarily unprofitable, nor are large gains a sure index of profitable food consumption.

10. Roots were a valuable addition to every ration to which they were added.

THE ONE HUNDRED PER CENT PROFIT ANIMAL—THE SHEEP.

(A. T. Grimes, Greenwood, Mo.)

History teaches us that sheep keeping was the earliest of the arts. Abraham, according to scripture, viewed his flocks from his tent door; Laban sheered sheep; Isaac had vast flocks; Jacob used the wool to make his favorite son, Joseph, a coat of many colors. In ancient times a man's wealth was reckoned by the size of his flocks. Sir J. B. Lawes, the first agricultural experimenter in the world, in the reports of his work of more than fifty years proved that sheep may be made to yield fifty per cent more profit than any other animal.

A well fed flock of sheep is the most profitable property a farmer can own. It is sometimes said that the dairy cow is this. If that be true, why is it that the number of sheep has increased over three millions in Great Britain in the last few years, until now there are over three hundred sheep to every square mile? Sheep raising is looked upon by many as a primitive industry, suited only to poor lands and undeveloped agriculture. If sheep were suited only to rough and waste lands, why is it that in Great Britian the tenant looks upon his sheep as the surest rent payer on land that is worth from three to five hundred dollars per acre? The sheep business has passed the primitive stage. We can count on a well established and increasing demand for our mutton products. The people of the country, and in fact the consumers of all the American Packers' products, are demanding more mutton, and those who never ate the flesh of the sheep before, once having tasted its fine flavor and discovered its high nutritious value, are becoming steady consumers of it, and not only is this the case, but when this best of all fresh meat is introduced it stays and the demand for it increases. We have always advocated that any farmer in our State can keep a small flock with satisfactory success. Failures in the keeping of sheep invariably happen in having too large a flock to begin with, for if one is able to keep successfully a small flock, which any person with good judgment and good common sense may do, is no reason that he can keep a thousand with the same success, for in all arts appertaining to agriculture there is no branch so difficult to become proficient in as the shepherd's art. This does not apply to sheep alone. Let any man overstock the capacity of his farm with hogs or cattle, and disaster is sure to follow.

In my thirty years of experience in the sheep business I have always found that my sheep have always made me more profit for the feed consumed and the capital invested than any other stock. I have made one hundred and fifty per cent profit on grade ewes raising early lambs for the Easter market.

MANIFOLD SOURCES OF PROFIT.

Sheep in fact turn into money in various ways: First is the meat, whether from hot house lambs, ripe weather or fat ewes that have raised several lots of lambs; then there is the wool, which is commanding a good price and which is harvested in the spring of the year, so to speak, when the farmer has the least to sell from any other source, and as our wealth and population increases, greater is the demand for the best of woolen goods. Good, warm flannels are and always have been one of the first and most essential things in man's infancy, and as we pass the prime of life and enter our second childhood and these old, frail and decaying bodies become rheumatic, there is nothing that revives, stimulates and makes us feel like the spring of life more than the good old flannel shirt. And last, but not least, is the constant improvement of the land which sheep, with their "golden hoof" and rich manure, never fail to bring to the tired and worn out cultivated field. Sheep is the one hundred per cent profit animal, whether it be grazing on the rocks of the Ozarks, or on the rich and rolling blue grass pastures, or fertile fields of this great State of ours; and there is nothing that beautifies, or excites the artistic eye or makes the farm more attractive and pleasant than a well cared for flock of sheep. It is not my intention to tire you with dry figures of what some individual has done in the sheep business to prove that the sheep is the one hundred per cent profit animal, but if there is a "doubting Thomas" here, if he will come to me personally, I will prove to him, beyond a doubt, that the sheep, properly cared for, is the most profitable animal that walks upon the face of this green earth.

BRIGHT PROSPECTS.

The shepherd's star never shown brighter in the State of Missouri than it does today. There is every encouragement for a prospective shepherd to start in the sheep business. If you have never had any experience in the business, let me warn you to go easy, and buy few ewes and figure on improving in the future. One of the principles of success is to raise each year lambs that are better individuals than their mothers. Have your ideal. You know the ones that answer to the accepted type and to your ideal. Study your flock; you know the ones that raise the best lambs and shear the heaviest fleece, you learn to discard the coarse head, the heavy ear, the long leg, the cloudy wool and dark skin. Hold on to the ones that conform the nearest to your ideal, and the most essential and important part is good care. As some one has said, "A wise shepherd feeds his lambs a month before he sees them and the foolish shepherd a month afterward." I want to impress upon the minds of all that in all my experience the one essential and most important thing to remember to make the sheep business profitable is care. Care will make constitution; care will ward off diseases; care will make size; care will save feed; care will make fat, and fat makes more and better wool. Yes, and with care will convince any man that the sheep is the one hundred per cent profit animal. Now in conclusion let me say, that the aim of every farmer in our State should be to keep a small flock of sheep, and it can be shown by figures of the most truthful character, and that can not lie or deceive, that this can be done on what is now wasted on thousands of Missouri farms and the profit from the flock well cared for will be one hundred per cent, if not more.

ADVANTAGES OF PURE BRED OVER GRADE SHEEP.

(J. W. Boles, Auxvasse, Mo.)

In the discussion of this question, whatever may be said in favor of pure bred sheep may be applied to almost any other pure bred stock, so, if I get off the question, you need not be surprised.

I am glad to know that the sheep industry is becoming more interesting in Missouri, and hope the time will soon come when she will rank where she should in the production of good sheep.

Sheep are nice to handle; they are the cleanest stock on the farm; they are the best weeders we have. Sheep can be kept more cheaply than any other stock; they will come as nearly making one hundred per cent a year as any stock kept on the farm.

Now the question arises, "What kind shall we raise?" I say the best, for we all know the best is the most profitable and gives the most pleasure.

In starting in the sheep business, then, shall we lay a foundaiton with pure breds or with grades? Without a solid or substantial foundation we can not build a permanent structure. Good seed must be sown in fertile soil in order to reap a bountiful harvest. The purer the seed the more perfect the offspring. Perfection gives value and appreciation.

The breed of sheep that distinguishes itself from all other breeds by its type, form, markings and general make-up is a pure bred, for in pure breds only of all classes of stock do we find such marked distinctions.

Our foundation stock must be pure if we wish to establish a distinct herd.

I presume there is not one of this assembly who breeds stock that uses a grade sire, yet a very large per cent of the farmers of the State of Missouri do breed to grade sires. Especially is this true of sheep, and for this reason, I presume, it has been said that "Even Missouri, which raises more mean lambs than any other state in the Union, sends a few convincingly good lambs to market."

I wish I could say something, and in such a way, that I could impress everyone present so deeply that he would advocate the importance of using pure-bred sires with his sheep.

Think of one of the most productive states in the Union and one of the best sheep states sending the meanest lambs that go on the Chicago market. I am truly ashamed of the condition of the sheep business in our great State. There are no states that excel us in the production of good horses, mules, cattle and hogs. Something must be wrong. If there is a remedy, let us find it. I believe we can, by using pure bred sires and dams, when it is practicable, raise the standard of our sheep.

I use both pure bred sires and dames with all the stock I breed, and have never had to sell an animal for less than a grade price. Even the chickens, dogs and corn are pure breds.

I have formed the habit of trying to improve my herds by using pure bred breeding stock. I believe that there are many farmers that just drift along and breed grades simply from mere habit. We have to be educated to paying good prices for pure bred stock before we can see the importance of it. When we get in the habit of getting good prices for our sheep we feel all right.

It takes the same care to save a grade lamb that it does a pure bred. The same quantity of feed keeps each alike. If a grade will make you one hundred per cent a year, it will be from one-fourth to one-half of what a pure bred ewe will make you with a little more money invested for the breeding stock. A five-dollar grade ewe will raise you a $3.50 lamb; a $20.00 pure-bred ewe will raise you a $12.50 to $15.00 lamb.

On the road to the station last fall I overtook a neighbor who was driving 100 breeding ewes worth $5.50 each. I had in my wagon six ewes worth $35.00 each, and I could not see why my one ewe was not more valuable to me than six and one-third of his would have been, as she ate one-sixth the feed and brought as much money.

The man who saves from 90 to 95 per cent of his lambs can not afford to breed grade sheep. His labor is worth too much and his time is too precious. It is as easy to raise a $25.00 lamb as it is a $5.00 lamb, if your foundation stock is right and you give them the proper care. A careless or negligent person would better breed grades, if anything at all, for he has not so much money invested.

I would *not* advise every farmer to raise pure bred sheep to sell as breeders, but I would insist that almost every farmer ought to keep a few sheep and use a pure bred sire. One great hindrance to the pure bred business is that we sell too many inferior animals for breeders. Though the pure bred scrub is better than a grade scrub, neither should be used. With the demand we have for better class of mutton and wool, we can not afford to raise an inferior kind.

Early maturity and easy fattening qualities are other features in favor of pure breds over grades. The time is at hand when we must pay more attention to our breeding stock. The demand for high-class material is upon us in every department of business. The moneyed classes are eating more mutton than ever before. A superior quality of wool is also demanded. The grade sheep will no longer supply our wants. We must improve our herds or quit the business.

I feel that we are awakening to a keen sense of the demand for better sheep, and that it is only a matter of time before every flock-master will use a pure bred sire and that many will have pure bred herds. Cross-bred sheep are good for specific purposes, but not proper for breeders. Let our motto be "Purify our herds." By improving our herds we not only elevate our great State in the estimation of the world, but we educate ourselves to a higher appreciation of things that tend to make men good.

The most energetic and progressive and up-to-date men that we have today in the live stock business are men who have long since quit the scrub. The prosperity of our country depends very largely on the improvement of our farms and herds, and it behooves us to use the best breeding stock obtainable.

I would say in conclusion to any one who is thinking of starting in the stock business, to study your own disposition and character, your environments and your capacity for business, and then buy a few of the best of the kind you like, and make it a life-time business if you would attain the greatest success. Read some good sheep paper and keep posted.

A WORD TO THE NEW BREEDER.

(Hayes Walker, Kansas City, Mo.)

Your program committee asked for a paper on the data of pure bred live stock, filled with figures and statistics, but it would be a very dry subject, and worth nothing unless one could remember all the figures—a task both tiring and almost impossible. In considering such a subject and the figures pertaining to it, apart from other and parallel facts in contemporaneous industries, the breeder of pure bred stock or the beginner is very apt to be frightened by the apparently "bearish" figures at hand.

The most recent estimates obtainable of the number of pure bred cattle recorded that are now living are 260,000 Shorthorns, 120,000 Herefords, 62,000 Aberdeen Angus and 16,000 Galloways.

The young man who contemplates going into the pure bred stock business argues to himself that with so many registered cattle now living and the present magnitude of the industry the business cannot continue, that it is not on a stable foundation and that it is liable to be overdone.

The figures given look big. They are, and they are growing larger each year. Yet this, so the older ones tell me, was the same argument against the pure bred business twenty and forty years ago. Yet it continues to thrive, with the demand and values on about the same plane. In England where they have been breeding pure bred stock for many, many years, more than in this country, their values now are higher than ever.

We hear the prophecy every day from men of affairs, from people who study conditions, that the growth of this country has barely commenced, and that in fifty years or less our population and resources will be doubled. If this be true, and few doubt it, this "bearish" argument of our doubtful friends has no place now, and will not have, at least, until we have reached our largest growth.

In my own brief experience as a fieldman on live stock papers and in the larger experience of others with which I am familiar, I never have known of any failure of breeder of pure bred live stock through any weakness or fault of the business. There have been failures, and many of them, but the cause can be traced invariably to some gross mismanagement or poor business judgment of the breeder, aside from any fault of the pure bred.

We will suppose, however, that our friend has overcome all arguments and fears, and proposes to buy a few pure breds and become a breeder. I do not pose as a know-it-all, and do not wish to appear presumptuous. I wish simply to make a few suggestions from my experience "on the road," during which I have visited several hundred herds of pure bred stock. I hope some of them may be of value and that the breeders will take them for what they are worth.

My first suggestion to the beginner, whether he is breeding cattle, hogs, sheep, horses or other stock, would be: start with good animals. Start right at the top today—and keep going higher. This is possible. You can commence with good ones just as easy as with poor animals. If you start your herd with the other fellow's culls, just because they don't cost much, you are handicapping yourself. You are not getting a "start," but are really buying something that will hinder you. If you commence that way you will never have anything to sell except "culls," and you can't sell them except to some one else who knows as little as you did when you began. You can "breed up," of course, but it will take a long time. You will be ten or twenty years that way in securing what you might have had at the beginning, and it's the exceptional breeder who "breeds up" his herd without buying something better than he already has. It's not only quicker and easier to start right up at the top, but it's more profitable, and there's more satisfaction in having as good stock as anybody else has.

Start your herd with as much uniformity of type and individuality as you can secure. That generally means, just as truly, a uniformity of pedigree. Visit as many good herds as possible. Visit the big live stock shows. Study the animals and select a type that suits you, and stick to it. Your herd will always look better and the produce will sell better. Don't have a miscellaneous collection of different types or too many families.

One good breeder recently told me if he were again a beginner he would secure for his breeding herd females all sired by the same bull. He did not mention any particular sire and did not mean any certain one, but he meant in that way to secure his brood cows all of a particular and individual uniformity. Some sires do not breed uniformly, it is true, and the buyer should be careful in that regard. My friend reached that conclusion after ten years of experience trying to "breed up,' discarding culls and making subsequent and wiser purchases. He has succeeded, finally, and now has a fine herd, but at a loss of ten years of time, and has just now reached the degree of excellence he might have started with ten years ago.

Ten or twelve good cows are better than two or three times that many of the ordinary kind. The produce from a few good ones will bring two or three times as much money, and you have less to feed and handle.

My most earnest suggestion to the beginner is this: Don't be afraid to ask for advice and information from people who are competent to advise. The man who knows that he doesn't know is the wisest, they say. There are so many points in individuality and pedigree that the uninformed may make irreparable mistakes. You can unintentionally buy unfashionably bred animals or animals otherwise good but lacking in breed type or other characteristics that you do not notice and will not notice perhaps until you come to sell their produce. You can never sell them unless to another uninformed breeder.

It is unnecessary to be a "pedigree crank," but it is just as unnecessary to burden yourself with a lot of unfashionable pedigrees simply to prove your independence and freedom from fashion's decrees. Life is too short to try to educate the world to your way of thinking, especially when there may be some doubt as to your own education. It is just as well to ride in the band wagon with springs and cushioned seats, especially when the fare is the same, and you are sure of a speedier and more comfortable ride.

It will take some money to start a pure bred herd. You will have something at stake, and should give them good care. To improve them requires more thought and more attention than you think. Don't imagine that pure bred cattle require no feed. I have seen some herds that made me think their owners believed their cattle were a kind of supernatural animals and could live on their purity of breeding alone. They can't do it, and you can't "grade up" a breed that will. Keep them in good condition all the time. They will create a better impression, they will bring better produce and will always command a price that means greater profit. If you keep them in poor condition you can expect no improvement, but a retrogression.

But one must love the business to make a success of it. He should study it carefully and continuously. He must keep up-to-date. He can improve his own stock, but others improve theirs, too, and in different points. One man cannot learn it all in his own experience, but he can be in the world and of it, and learn to profit by the experience of others. There is a fascination about the pure bred business, aside from the commercial feature, that appeals to me, and I believe most of the actual breeders find it so.

This thing of improvement—of doing something better than it has ever been done before—of making a better animal than its ancestors—brings a sense of satisfaction and pride that is of itself its own reward.

AN EXPERIMENT IN PORK PRODUCTION.

(E. B. Forbes, Assistant Professor Animal Husbandry, Missouri Agricultural College.)

In the spring of 1905 the Missouri Experiment Station made a comparison of several of the best concentrated supplements to corn for dry-lot fattening of hogs, and the practical outcome of this test is set forth in the following table:

Lots.	Rations.	Grain per cwt. gain. Pounds.	Average daily gain. Pounds.	Average daily feed. Pounds.	Cost of 100 lbs. gain.	Value of supplement. Ton.	Average initial weight. Pounds.	Average final weight.
1	Corn Meal	471.7	.91	4.31	$3 37	....	114.2	169.0
2	Corn meal, 18%; wheat middlings, 82%	383.3	1.27	4.85	3 63	$17 06	117.4	193.4
3	Corn meal, 82%; linseed oilmeal, 18%	357.6	1.68	6.00	3 18	40 06	119.8	220.2
4	Corn meal, 80%; soy beans, 20%	340.4	1.69	5.76	2 99	42 34	118.6	220.2
5	Corn meal, 92%; tankage, 8%	355.8	1.67	5.95	2 97	72 34	116.6	217.0
6	Corn meal, 61%; germ oilmeal, 39%	401.1	1.06	4.26	3 79	20 68	120.1	183.8

Cost of feeds:

Corn meal	$00 40 per bu.
Wheat middlings	20 00 per ton.
Linseed oilmeal	34 00 per ton.
Soy beans (assumed)	34 00 per ton.
Tankage	44 00 per ton.
Germ oilmeal	26 00 per ton.

The rations are in each case, except the first which is corn meal alone, "balanced" in the sense that the proteids and carbohydrates are furnished in the proportion in which they are required by the animals. In each of the mixed rations the nutritive ratio of the digestible nutrients was 1:6.5—that is, each contains 6.5 times as much starch equivalent as protein.

Five young hogs were fed in each lot, and at the beginning of the experiments they weighed between 114 and 120 pounds each. They were fed for sixty days and sold at weights of from 170 to 220 pounds.

The feed was all ground and fed mixed up with water into a thick slop, and each ration was fed twice daily to the limit of the appetite of the lot receiving it.

The first column of figures in the table shows us that lots 3, 4 and 5, in which the corn was supplemented by linseed oilmeal, soy beans and tankage, required just about the same amount of feed to make 100 pounds of pork. These three rations were considerably more efficient than those containing wheat middlings and germ oilmeal as fed to lots 2 and 6. All of these mixed rations were decidedly more efficient than corn alone as fed to lot 1.

The second column of figures shows that the average daily gain per head corresponded very closely with the efficiency of the feeds as shown by the grain requirement per hundred pounds of increase in weight. The linseed oilmeal, soy beans and tankage rations each produced average daily gains of about 1.7 pounds per head, while the three other rations were much inferior to these. The more efficient rations were also the most palatable ones as is shown in the third column of figures. Since the hogs regulated the amount consumed to suit themselves, these figures show which feeds were relished best.

The feeds are considered to have cost at the farm, as indicated by the prices given below the table, allowance being made for freight in the case of those food stuffs requiring shipment from a distance. The soy beans were assumed to have a cost the same as the linseed oilmeal just for comparison, it being considered that if the beans produced pork as cheaply as the oilmeal, when figured at the same price, attention might be called to the profitability of producing this feed upon the farm.

The soy bean and tankage rations produced pork at 3 cents per pound, while the linseed oilmeal ration produced pork at $3.18 per hundredweight.

The ration of corn alone was not as profitable as the three above mentioned ones, but because of its cheapness produced pork at a lower cost than the rations containing middlings and germ oilmeal.

The fifth column of figures shows the values of the supplements. These are the values at which it is an even thing, whether they be fed with the corn in balanced rations or whether the corn be fed alone. As long as these feeds cost less than the values as here stated, pork may be produced more cheaply from the use of the supplements than from corn alone. One must also bear in mind the fact that the supplemented rations produce pork much more rapidly than corn alone.

The middlings costing $20 per ton were worth but $17.06; the germ oilmeal costing $26.00 per ton was worth only $20.68, but the linseed oilmeal, soy beans and tankage all returned handsome profits.

The tankage was bought from Swift and Company at Kansas City, Missouri. It is dried and ground meat scrap, is thoroughly sterilized and is a safe and profitable food. It is so concentrated that but little of it need be handled. The less concentrated supplements, wheat middlings especially, require too much labor in hauling from town.

The showing made by soy beans is especially favorable to the farmer since he can produce this feed himself. The beans may be cut a little early and stored as hay for winter feeding or they may be hogged off in the fall, corn being fed in addition. This last method has much to commend it and will grow and fatten hogs very rapidly at a minimum cost in feed and labor.

GALLOWAY CATTLE.

(R. W. BROWN, CARROLLTON, MO.)

Galloway is the name of a province situated in the southwest part of Scotland. In ancient times it was composed of six counties and enjoyed a sort of independent government. Its surface is very irregular, but among the high hills are many fertile valleys and numerous small lakes. It borders upon the North Channel and its climate is mild and moist.

In the histories of this province, as early as the twelfth century, we find mention made of a breed of polled black cattle. Ortellios, the celebrated geographer, writing in 1573, says: "In Car-rack (a part of Galloway) are oxen of large size, whose flesh is tender, sweet and juicy." The fame of these cattle gradually reached out into England and Scotland, and they soon became known as the Galloway cattle. After England and Scotland became united the farmers of Galloway found a market for their cattle among the feeders and graziers of England. This trade grew until toward the end of the eighteenth century as many as thirty thousand head were sent annually to the counties of Norfolk and Suffolk, where they were fitted for the London market. Smith, in his agricultural survey of Galloway, says: "What above all may be regarded as decisive of the merits of the Galloway breed is the uniform testimony of the Norfolk graziers, who have long given them the preference to every other breed of cattle. Their average price is two pounds per head above that of any other breed the same weight." Aiton, speaking of these cattle, says: "It is well known that the Galloway breed of cattle have, by the attention of the inhabitants, been brought to a degree of perfection for feeding equal or superior to any breed in Great Britain. They possess all the excellences of shape, size, constitution and qualities that can recommend them to the English graziers. They are of a tolerable size and very handsome. They are spirited, strong, very healthy and hardy, and *no* cattle whatever feed better or yield beef that is more relished at table, as can be well attested in all parts of South Britain."

The object of the breeder at that time was to raise as many good animals as he could for the market. The best heifers were retained in the herd and the rest sent south with the steers. Thus the breed was improved by the systematic mating of the best specimens of each sex, and not by the crossing of any other breed. In winter the cattle ran out, much as they do here on our western ranches. This improved the hardiness of the breed. With the introduction of turnips and modern methods of farming into Galloway, improvement became more rapid, and after the advent of railways many of the cattle were fattened at home. About this time a trade sprang up with the farmers of Scotland and England for bulls to cross on other breeds, mostly Shorthorn and Ayrshire cows. This was the birth of the pure bred business, and it became apparent that to maintain the purity of the breed some kind of a record must be kept. Unfortunately, all early records and documents were lost in the fire that destroyed the Highland Agricultural Society's museum and records in Edinburgh in 1851. In 1862 the Polled Herd Book was published, and it contained the records of the Aberdeen Angus and the Galloways. In 1877 the present Galloway Cattle Society was organized. In 1853 was made the first importation to America and in 1872 registration was begun, and a few years later the American Galloway Breeders' Association was organized.

Since the first importation to America many improvements have been made upon the type of the Galloway, but many of his characteristics remain unchanged. Nothing is known of the origin of this breed of cattle, but from time immemorial they have been hornless. The unvarying test of the purity of a Galloway is, there must not be the slightest trace of a horn or scur.

In color, the Galloway is black, not a pure black, but with a brownish tinge. The calves with their first coat of hair are usually a dark mahogany brown. Many families have more or less white on the underline, but above or below that any white may not be, but is considered a sign of impurity, and debars the animal from registration. Accustomed as the Galloway has been for centuries to an outdoor life, he now has a soft undercoat of thick, mossy hair, with a long, wavy outside covering. Coarse, curly hair is very objectionable.

The hardiness of the Galloway is proverbial. If necessary, he will face the wind and the snow, and travel miles for food or water. They acclimatize readily and feed on a large variety of plants. In Scotland herds are maintained where no other breed can exist. Quite recently Prof. C. C. Georgeson, who has charge of government experiments in Alaska, shipped a car load of breeding cattle to that cold climate, and recent advices from there inform us that they are doing even better than Prof. Georgeson had expected. He says there is no other breed of cattle that will stand the Alaska climate. On the other hand, there have been several shipments to the Republic of Mexico, and they are doing equally well there.

As a beef producing breed, the Galloways have a reputation that is excelled by no other. They topped the market centuries ago, and are topping it today. Joseph Hill, the English butcher, says: "As a beef producing breed, there are no other cattle equal to the Galloway. The quality is superior to any I ever killed." John Cross, another English butcher, says: "It is my opinion that Galloway cattle are the best butcher's beast, both as regards quality of beef and proportion of offal. They are without doubt what is wanted at present—beef, not bone and fat." From the fact that the meat is evenly marbled and laid on the best cuts arises its superiority. The statement is sometimes made that the Galloway is not an early maturing animal. The nature of the country, the diverse methods employed by the farmers of Galloway, originated or developed two distinct types of the breed. Away up among the hills and mountains was developed a type that matured at two to four years of age, while in the low lying valleys, where pastures are more luxuriant and other feeds plentiful, the calves remain fat the year round, and thus originated the modern Galloway, the popular, early maturing type of to-day. The former has almost been eliminated, but we occasionally see specimens of this Highland type today, but I dare say no more often than we see the same specimens in other breeds. The Smith field fat stock show has records of Galloway two-year-old steers weighing over two thousand pounds and yearlings over fourteen hundred, and even in the early days of the breed they frequently topped the London market, weighing from nine hundred to fourteen hundred pounds as yearlings. In our own feeding experience, we have purchased range bred steer calves weighing less than five hundred pounds, and returned them to market in a year's time weighing over thirteen hundred. Mr. Leslie Smith, manager of the Meadow Lawn herds of Shorthorn and Galloway cattle, told me during the recent International Live Stock Show that in his judgment (and no man is more competent to judge) that the four Galloway female calves exhibited in their young herd this year were the equal of and were as well matured as the four females of any young herd of any breed in the show.

One of the other important characteristics of the breed is the prepotency of the bulls and their ability to impress their characteristics on the offspring. Ninety-five per cent. of the calves from any cross will not only be uniform in quality, but will be black and without horns. There is no breed of cattle that will breed up a scrub herd quicker than a Galloway. It is also a fact that tuberculosis is almost unknown in this hardy breed of cattle.

The true index of what a breed is doing is shown by its association records. This tells us that the Galloway is spreading out in every section of the United States and Canada. Recent shipments have been made from the corn belt to Utah, California, Alaska, Virginia, Florida and into the Republic of Mexico. It tells us the increase in membership in 1905 was double that of 1904—that the receipts of the association were thirty-five per cent. greater in 1905 than in 1904. It tells us that the range men in the west, southwest and northwest are picking up good Galloway bulls as fast as they are produced. The Galloway is making a name for himself today, as he did centuries ago, when he was driven four hundred miles across Old England to the market of London. On the range, in the feed lot, in the breeding herd, he is proving his merit, but it is probably in the show ring that he has made the most improvement in recent years. One of the most frequent remarks heard at the show is: "The Galloways are making better progress than any other breed," meaning, of course, improvement toward show yard conditions, for it is only a few years since the Galloway breeder, a novice to the art of fitting for exhibition, sought entrance at the gates of our national shows. Today there are more good Galloways seen at our shows, in proportion to the number of animals, than any other breed. For example, at the recent International, there were about seventy-five Galloways in breeding classes. Had the exhibits been in proportion to the number of registered animals in each breed, there should have been fifteen hundred Shorthorns, six hundred Herefords, three hundred Angus. In classes where they come into competition with other breeds, they win their share of the honors. In the range-bred feeder class, Galloways won three of the six grand champion prizes offered by the American Royal and the International since these shows were established, or as many as all the other breeds together. Few Galloway steers have been fitted for these fat stock shows for two reasons: first, the breeders have always had an active market for their best bulls and the steers that come from this source are second class animals. Secondly, the great majority of Galloway steers are marketed by feeders who are not interested in any particular breed. The popularity of the Angus breed today has been made so by such men as Funk, Kerrick, White and Krambeck, men who make it their business to raise high class steers, whose sires and dams are the best specimens of the breed. Mr. Jacob Funk said of his champion load of steers: "The foundation of this load was laid over fifty years ago by Isaac Funk. Some of these steers were from pure bred cows and all of my own breeding." Mr. Deane Funk, commenting upon this load, says: "During a series of efforts to capture this trophy, extending over six years, I have ridden the country night and day, always with both eyes open, for a promising animal. Frequently I have secured one that looked a part of a winner, standing alone, but he degenerated to the value of about thirty cents when turned in with the rest." As the Gazette puts it: "You must be a breeder as well as a fitter," and the Galloway breeder, as well as any other who aspires to championship honors, must adopt similar methods and sacrifice their very best bulls. In the carcass contest, the Galloways, with their finely marbeled meat, have been more successful, always standing well up in line and have won championships both in this country and at Smithfield.

The remark is frequently made that "there are not so many men going into the Galloway business," but it is equally true that there are not so many going out. "That they do not bring as high prices"—neither do they bring such low prices as some of the other breeds. It is a fact that we hardly ever sell a bull in our own county, because the farmers can go out and buy pure bred bulls of some of the other breeds at from thirty-five to fifty dollars. I am sure if we could get at the returns of the sales of pure bred cattle, you would find that the Galloway averages as high, if not higher, than any other breed. I attended two dispersion sales of pure bred cattle in my home county last year, one a Galloway herd, the other of another breed. The Galloway herd had not been kept up and had dwindled down to three old cows from thirteen to fifteen years old, that averaged over sixty dollars. The other herd was as well kept and as well bred, some of the animals having been added to the herd at a cost of eight hundred dollars per head. This herd was just in its prime and their average was not quite seventy dollars.

I am not giving you these comparisons in an unfriendly spirit. If there is anything that the Galloway is proud of, more than another, it is of the company he keeps, the white face, the doddie and the red, white and roan. Not a competitor but a co-partner with these magnificent breeds in their fight against the scrub. Missouri for pure bred cattle and better beef.

"THE RED, WHITE AND ROAN."

(Address by Col. W. A. Harris, of Kansas.)

Mr. Chairman, Ladies and Gentlemen: I cannot tell you how pleased I am to have an opportunity to be with you this afternoon. I did not know what I was to talk about until a day or two ago, when I came across a copy of your program. I found that I had been put down as W. A. Harris of Chicago. I felt somewhat aggrieved at that, because that has been the means of inflicting some very deep scars upon my political body in the past; in fact, it has inflicted more than any other one thing. I am glad, however, that your chairman has located me properly in introducing me to you.

I am from Kansas. Let that be distinctly understood. The subject of the romance I am to relate to you broadens out, as I think of it, more and more, and it seems almost impossible that in a brief off-hand talk I could give you any idea of the wonderful romance, of the wonderful extent and the wonderful interest conveyed by those simple words, "The Red, White and Roan."

It has been said that the beat of the British drum salutes the rising sun around the globe incessantly. It may also be said that wherever the British have beat the drum to salute the rising sun, they have taken with them the red, white and roan. It is a well-known fact that there is no island in the sea, no corner of any continent, no land or realm where the English race have entered, but where you will find the blood of the red, white and roan. It seems to have been a perpetual custom on the part of the English-speaking people to carry with them this magnificent animal, and I think the world is a great deal richer for it.

After having devoted nearly a lifetime to the study of the red, white and roan, and endeavoring to upbuild its fortunes as well as I could in this great new west of ours, I had the pleasure of traveling over the wonderful country where this great animal first came to light, and a remarkable country it is, indeed.

That portion of England lying in Cumberland, Yorkshire and Durham counties, extending from the city of York north, until you reach Durham, situated on a magnificent bluff, overlooking a beautiful stream, towering above everything with its wonderful cathedral, is a perfect garden; a beautiful undulating country, filled with rich meadows and gently flowing streams. There seems to be no broken or worthless land anywhere. And as I traveled along from spot to spot, connected with the early history of the shorthorns, it seemed to me the birthplace was worthy of its offspring. It was a wonderfully rich country, and, as you know, away back in the early ages those regions were seized upon by the monastic orders, and all through this portion you find traces of the wealth and power to which those monasteries reached. The monastery of York is probably the most worthy example of cathedral architecture to be found anywhere, and as you go north from York to Durham you find everywhere traces of its institutions. The monks were intelligent men for their time; they understood good living and knew how to practice it and enjoy it; they understood good farming, and they sought the richest and best land; they cultivated it to the highest possible extent known to that day; and they took up the subject of improved cattle and horses, and it is simply wonderful to go away back—as far as we can—in the old records and find that for thousands of years those old monks, by careful selection of grades, built up new standards in live stock, and to study the elements that were to be found at the beginning in the herds of large white cattle which were to be found in Chillingham Park, and one or two other places in England. They are typical shorthorns in many respects—white, with red ears and white noses; straight hind leg and quarter; and, except for their diminutive size, one would think they were more or less of the shorthorn blood of today.

Probably some importations from Holland were made a good many centuries ago, and thus additional milking quality infused in the strain. They went on century after century, but all the way through we can trace their growth. The cathedral at Durham was founded in the year 1099, nearly a thousand years ago. The present structure is a reproduction of the original or old building, and yet on the walls of the main entrance there is a cow, with two dairy maids by her side, and she is to all intents and purposes of shorthorn type. This shows that at that early day they had a conception of the same qualities that we note as desirable. It has the old double udder, but seems to lack size and scale. The illustration shows it was not as large as we would have cattle today. But there was, nevertheless, the beginning of this wonderful progress, the beginning of this wonderful change, and as I spoke awhile ago of the tastes of those old monks for good roast beef and the good things of this life, it seems to me the most perfect hotel, so far as comfort is concerned, I ever saw in my life is the station hotel at York, the center of the clergy in England. The Archbishop of York is the great ecclesiastical agent of the king, and there attend upon him clergy of all ranks, and I find the clergy of today equally as fond of the many comforts of this life as the monks of the olden day must have been. That is a most delightful hotel; it is most beautifully furnished; it is quiet; attentive servants with limp slippers attend them; beautiful wax candles complete the effect of the scene at night. They feast upon the finest wines and the finest meats it is possible to produce or obtain. So I imagine this love of luxuries has been handed on down from the old monastic orders in the years five and six hundred. Was this not a fitting birthplace for the greatest of beef animals?

The work of carefully selecting and breeding these animals went on for centuries, and was no doubt somewhat similar to what we are doing today. It went on until gradually these characteristics that were desired came to be almost fixed in the animals, and this thing we call "prepotency" became impressed in this breed of cattle as in no other. No other cattle, no other tribe of domestic animals has it to such a wonderful extent as the "roan." About the end of the eighteenth century, however, they began to preserve what we call pedigrees instead of mere tradition, as that a certain animal was from F. Brown's red bull or J. Dixon's bull. Those are the only sires, as you know, at the bottom of shorthorn pedigrees today.

Charles and Robert Colling deserve, more than any other two men, credit for bringing all this scattered material into one systematic compact whole, and they did it by introducing novel ideas in regard to breeding. About that time Mr. Blackwell, in the southern part of England, had achieved considerable success in improving the long horn cattle of that day. He had also wonderfully improved the Leceister sheep of that day. Charles Colling was an enterprising young man who had just taken the beautiful farm of Quentin, which I viewed with a great deal of interest, as it is today just as he left it. He spent a week with Mr. Blackwell, and finally that gentleman explained the mystery of his operations and success, which was simply a scientific application of the principles of in-breeding. It was the beginning of his breed, but Mr. Blackwell found that by breeding sire to daughter and brother to sister for generation after generation, he absolutely fixed the type he desired to hand down.

Charles Colling went home with that idea. He had been successful, as you know, in finding a wonderful red bull called "Hubbard," but he was recognized as a pure short horn bull. His dam was a cow recognized as possessed of wonderfully mellow skin, beautifully developed form and symmetry, and it was known that he was out of a beautiful short-horn bull. Mr. Colling took this bull "Hubbard" and used him freely. He did not continue to breed him as long as he should have done, but parted with him. However, he found that the descendants of Hubbard were remarkably fine and similar specimens, and, as you know, when he obtained "Favorite," a direct descendant of Hubbard, he actually used three crosses in succession of Favorite upon his own offspring. The result was the bull "Comet," the most wonderful animal that had been seen up to that time. And when Mr. Colling, because of failing health, retired from the business, he sold Comet for six thousand pounds. The introduction of Comet was a nepot in shorthorn breeding. The doctrine that like produces like or the likeness of some ancestor was thoroughly substantiated, and from Hubbard on down to Comet it was shown that pedigree, rightly used, was the only safe plan for breeding improved cattle.

When Mr. Colling's herd was dispersed, we see wonderful development again, when Mr. Bates, who lived hardly five miles away from the Colling brothers, went on with the work. He had ridden over to the Colling's one morning and found Miss Colling milking a beautiful cow called "Lady Maynard," and Mr. Bates was much impressed with the cow, and he succeeded afterwards in obtaining her and her heifer calf called "Duchess." That was the foundation of a wonderful herd of cattle.

About the same time Booth brothers, in Northumberland, obtained some Colling blood, so we see Mr. Bates and the Booths, who were destined to become leaders of two great rival factions of shorthorns, obtaining their material at the same fountain head.

Bates was proud of the milking qualities of his shorthorns, and was also fond of their style and fashion; and he was prouder of those qualities than of their thick, heavy flesh.

T. C. Booth laid greatest importance upon the thick, heavy flesh, and asked his friends if the broad backs of his cows were not worth a few pints of milk. He cared little about the shape of the head, and the result was that the Booth cattle grew to have homely and unprepossessing heads, while Mr. Bates carefully watched the development of the finer points of beauty of his cattle.

The quarrel between the Bates idea and the Booth idea grew to be almost as bitter as the War of the Roses, which had so terrificly crossed England. Men became alienated from each other, and friends lost their friendship for each other, because of devotion to one or the other of these strains. I wandered all one summer afternoon over the fields of Northumberland with one of the descendants of Mr. Booth, and found that those cattle were at that time absolute facsimiles of those which had gone before. On the walls of their plain and unostentatious dining room there were pictures of Matchmaker, Tim, Brother Ben and bulls that had lived seventy-five to eighty years before, and yet out in the pasture was the precise prototype and facsimile of those bulls. And that is proof positive that it is to pedigree alone that we can trust for good succession, and I allude to pedigree, gentlemen, because I was amused this morning at the discussion of this question. (Applause.)

Mr. Bates and Mr. Booth continued breeding the same cattle, introducing fresh blood when required and inbreeding, sooner or later, going over to the other side and securing fresh blood. While it is absolutely impossible to dispense with inbreeding in founding a herd, if carried to excess it tends to reduce the strength of the animals, and ultimately to sterility and weakness in every possible direction. Mr. Bates used fresh blood over and over in order to restrain the waning fertility of his herd. The Booth family had been more careful, but frequently were compelled to introduce fresh blood, again welding the material together by inbreeding stronger and stronger.

You know the history of the two strains in this country. Shorthorns were brought over at an early time. With the colonists came to this country good Shorthorn cattle. I can remember hearing my grandfather talk about the "Roan Durhams" in Loudoun and Fauquier counties, Virginia, one hundred years ago or more. So we see everywhere the English people have gone they have carried the Shorthorn.

We began at first with the most catholic idea. We accepted anything that was brought over here. When Felix Rennick went to England in 1733, he cared little for family or pedigree, so far as a particular strain was concerned, and Mr. Bates attempted to convince him no strain other than his was worth bringing to this country. He labored with single eye as to purity and individuality, but not with regard to any particular strain. And he secured some of the best individuals in England. We have brought over immense numbers of cattle from that time on. In 1817 Sanders' herd was composed of splendid cattle and well bred, but that was prior to the establishment of a herd book. About 1815 old George Coates rode around Northumberland picking up information in regard to the pedigrees of cattle, and in 1822 he published the first English herdbook. That was the first time anything had been given out as a guide to people in purchasing cattle; and these cows brought over to this country in 1817 had no record, but it seems fairly certain that they were carefully selected and purely bred in every possible way. We had other importations, and from time to time other enterprising men went over. It was a serious proposition in those days to go to England and import cattle.

We have gone on and we have discarded the line-bred Bates cattle and the line-bred Booth cattle, because we found that a limit had been reached in this line-breeding and in-breeding; that it was coming to be detrimental and injurious, because these cattle would not respond to the demands we made upon them and did not possess the essentials we must have in our western cattle. About the same time there had been discovered an old Quaker way up in Scotland. Shorthorns were not indigenous in Scotland, and it is, therefore, absolutely absurd to talk about straight Scotch cattle. There is no such thing. You might as well talk about straight rail fences. They cannot exist. Captain Barclay of Ura was about the first to take the Shorthorns into Scotland from England. About 1819 Mr. Cruikshank bought some cattle of Captain Barclay of Ura, and he bought them absolutely without reference to pedigree or fashion or family. He said he must have cattle in Scotland which the average farmer could not afford to be without, and it seems to me in that little sentence is all the law and gospel in regard to cattle. Shorthorn breeders today must breed cattle which the farmers around us can not afford to be without. (Applause.)

Mr. Cruikshank bred them wrong for a great many years. He told me that himself. At the time I was over there on this visit I spoke of, I went to see the old man. We found "Siterton" to be a plain, unpretentious stone house with five or six rooms. On the north side was a plain, substantial stone barn with a few enclosures about it. The old man was wandering about them. He had dispersed his herd, but told us the history of each one of the individuals that had made his herd complete and his name famous.

Now, I commenced importing in 1882 cattle direct from Mr. Cruikshank's herd. I found the cattle I got sired by Roan Gauntlet, by Pride of the Isle, by Quarantine, were very much superior to those sired by their sons and grandsons. I found that the blood was a little too delicate, was a little infertile, and I brought the question right up to Mr. Cruikshank himself. I said, "Do you not think the time has come when your cattle need fresh blood? Have you not carried this inbreeding to its absolute and extreme limits?" He said, "There can be no question that that is the truth," but he said, "The younger men must do that. I am too old to go out and try the fresh blood, which must necessarily be done." As I recall that instance, I want my friends here to remember that we must do as Mr. Cruikshank did and told us we must do, and not continue to inbreed and inbreed, or we are going to reach the same end precisely.

This herd, however, had obtained about that time absolute supremacy over the Bates and Booth herds. Notwithstanding their wonderful character and purity, and notwithstanding the devotion and friendship I would lavish upon them, yet the question of practical utility, as put by the old Quaker at Siterton, became absolutely the thing of all things to be desired in this country, and in England as well. And though we had adopted this standard before it was adopted in England, today it is the blood of this herd which is supreme over all the world.

The question is, what is the duty of the Shorthorn breeder of today? We are using this Scotch blood because there is no purity in any Scotch blood except as it came from Siterton. Mr. Cruikshank was the man who established the separate and distinct type for what we call Shorthorns. We must not follow the examples of Mr. Bates or Mr. Booth in continuing to inbreed and to line-breed, but we must use fresh blood, in order to preserve the scale, size and fertility of our cattle. And there is another reason why we must do that. I dislike, when I attend a Shorthorn sale, to hear it said that an animal is "pure Scotch," when, perhaps, it traces back to the herds of Mr. Rennicke or Mr. Warfield or Mr. Ellis, because those gentlemen purchased the very best cattle to be found in England at that time, and the descendants of those herds compose nine-tenths of the cattle in this country of this breed. I dislike to see their value absolutely destroyed and men breaking their necks, and their bank accounts as well, in an effort to buy what they call "absolutely straight Scotch." I have seen cases where absolutely inferior individuals reputed as "pure Scotch" commanded higher prices than superior individuals not so reputed.

But I believe in pedigree. I believe it is the only possible means we can depend on in the production of good qualities. I believe like produces like; but we must not be slaves to pedigree. We must not carry it so far that it absolutely destroys the whole purpose and aim of pedigree, which is improvement all the time. When an animal is inbred, or by some means becomes inferior, it is the most dangerous thing in the world to our herds, because its inferior qualities have just as much prepotency as its superior qualities, and we are as sure to propagate the inferior qualities as the superior qualities it may possess.

I remember reading a few years ago an article written by Mr. Maynard himself. He said the whole art of breeding lies in studying the fitness of certain individuals for interbreeding with other individuals; in other words, that the key to success lies in being able to arrive at a correct conclusion as to how certain animals will nick with each other; what will be the result of breeding a bull of one shape to a cow of another shape. You can not select an animal with one marked superior point and expect it to be reproduced the first breeding. All the operations of nature are in the shape of compromises, and so are all changes of grade in our cattle. You can not produce a giant from a pigmy. You must do it by degrees. In breeding cattle this is a slow process; you must add here a little and there a little. You must refine and build up, and gradually improve those points that are weak.

Now, in doing this we have more or less to do with pedigrees. You may ask, what do I get out of looking at a long list of names; what does that mean to me? By so doing you will be able to find out the peculiar characteristics of each individual in that pedigree. Of course, it is very difficult for anybody, by studying a pedigree, to find out from his own observation, or from men who have seen the animals, the characteristics of more than a very few top crosses. By history you may find out about the peculiarities of some of the older sires, but all that should be threshed out and carefully noted. Then you should arrive at a sensible conclusion as to what type of animals compose that pedigree, and then you can judge with reasonable certainty what you are doing.

But mere pedigree without more means nothing. A scrub has a pedigree, an unwritten pedigree; it has ancestors just like any other animal. But it has ancestors that have not possessed qualities worthy of record. So we see we must appreciate pedigree in the proper way. I do not like to see this disposition to talk about closing the herd books. We must have herd books. It is the compass by which the breeder is guided upon an otherwise uncertain sea. But the servile worship of pedigree is as dangerous as anything that can possibly be conceived. It is above all things to be avoided. We find the same thing—this servile worship—in love, in religion and in politics. Men and women love often not wisely, but too well. We find men who become so wrapped up in religion that they have no tolerance whatever. If Methodists they will not speak to Baptists; if Baptists they will not speak to Methodists; if Protestants they will not recognize Catholics, and if Catholics they will not recognize Protestants. We find Democrats who pronounce curses against the Republicans, and we find Republicans who declare bloody warfare against the Democrats. (Applause.) Now, all these things are good. They are all necessary. We must have parties in political work; we must have creeds in our religious work. For somehow or other, we do not all like to travel in the same narrow road, however even and smooth. But we do not want to all try to become masters and to forget our reason in all these things, and this is true of breeders.

We must preserve our pedigree for what it now is, and we must not be afraid to introduce fresh blood, because every man who has achieved anything worthy of historical mention in the way of breeding Shorthorns has used fresh material right and left at times. Mr. Bates, who anathematized everybody else's cattle, found himself obliged to resort to Red Rose blood and Princess blood, and finally to taking the old Oxford cows blood into his strain, in order to build it up and strengthen the resisting power of his decaying Duchess tribe. The Boothes did the same thing. Mr. Cruikshank did the same thing.

But, of course, a man who has built up a herd until it becomes a family has pride, and a great amount of it. He can not help but feel that it is somewhat of a recognition of the merit of the other people's herds to go to them and take a bull or a cow from them; because the best way is to introduce new blood through a cow. Breed your own bull to a good cow of some other blood, and then breed the produce. That is what Bates, Booth and Cruikshank all did, and that is what they all told us to do. We seem inclined to repeat the errors of the past and to tie ourselves to one particular strain because it is fashionable. Often because a comparatively inferior strain is fashionable it may bring a higher price than a more worthy strain, and men discard all their, perhaps, more worthy and magnificent material for it. Nine-tenths of their stock we sometimes see men discard as worthless. This is all wrong. I want to see the American Shorthorn—not the Scotch Shorthorn or the English Shorthorn. (Applause.)

I believe that by properly using this great mass of new blood we have in this country and by properly breeding them, regardless of family or strain to which they belong, we can produce animals superior to those of all other countries, just as I believe the American citizen is superior to all others, just because he is bred in precisely the same cosmopolitan way. (Applause.) The American citizen is composed of a tremendous aggregation of bloods, and he has all the vigor and vitality that necessarily comes from that kind of intermingling. And I want to see this great strain of cattle brought up the same way, until we can show the old world what we have wrought out ourselves.

In 1882, as I said awhile ago, I was importing, and for a number of years thereafter, cattle from Mr. Cruikshank. I never dreamed of carrying those cattle along in the way they had been. But I wanted to infuse new blood that would strengthen my herd and give our cattle a better constitution. It was simply an addition to the great mixture we had in this country. And the best cattle that I have ever bred, and the best, I believe, that have ever been bred up to this time, have been bred with that kind of breeding and that kind of blood, all wisely and properly mingled together. That is my prescription for breeding good Shorthorns. That is what I would dearly love to see all through this country. The time is coming when we are going to have an immense market opened up.

We have not in this country a one-hundredth part of the pure bred cattle which we are going to and must have. Why, there are not enough Shorthorns in the United States today to properly supply the needs of Missouri, and as land becomes more valuable and rises in price, and gets to be one hundred dollars and upwards in all regions, the time is coming when there will not be a section of farm land in one of our States that does not maintain upon it a pure bred bull of some description. We will be forced to do it. We can not afford to use inferior feed or inferior stock on such valuable farms. We must pay interest on all this rapidly rising land, and they are already going back to cattle breeding in the Eastern States to do it.

I have often thought about the needs of Kansas. She has in her limits eighty thousand square miles, the eastern half of which is all farming country—forty thousand sections of farm land. Upon all those sections should be maintained a pure bred bull.

Illinois has fifty-nine thousand square miles of land. Upon every acre of that land, outside of the cities, should be maintained a pure-bred bull. Much of this land has come to be worth $100, $150 and $200 an acre in many parts of Illinois, and it is only by using early maturing cattle, with the highest possible feeding qualities and the greatest amount of utility in every direction, that we can afford to grow stock at all. We must grow stock; we cannot escape it. God has made the world so there is no other way of keeping up the land and sustaining the human race upon it except by raising live stock.

I remember an incident on my visit to Eastern England that impressed me most forcibly. I was walking upon the field of.... .... Colonel Godfrey said that land had never been broken since the Scotch and English were locked in the throes of their dreadful conflict upon it. He opened up a drain and found there a great accumulation of stag horns, which, he said, were from the stags driven there in great droves after the Scotch army. That land had maintained its fertility. It was as rich three years ago as eight or nine years ago, and all over England we find out that the soil has maintained its fertility to a marked degree because of her devotion to live stock. Everywhere in England it is grass, grass. The proprietors of grass land worth five or six hundred dollars per acre find that by using the proper kind of stock the most profit can be made from stock, and in most counties there is a severe penalty for breaking up the pasture lands, so devoted have the English become to the rearing of live stock. In fact, it is only in cases of emergency that this land is broken, and the result is that the average of wheat throughout Great Britain is forty bushels per acre. Doesn't that humble our pride and check our braggadocio a little bit? The average for Missouri is about thirteen bushels, and for Kansas about sixteen. But if farmed properly, as we will have to do, as this country grows greater and the value of property increases more and more, there is no reason why we cannot do equally as well as England. The time is rapidly approaching when there will be no more cheap land, and we will have to increase our yield in every possible direction. We are doing a wonderful work in this direction—your professors here and everywhere are doing a wonderful work, and it is all going to come into play in the vast future that is looming rapidly before us.

It is estimated that in twenty-five years we will have one hundred and twenty million people in the United States. Just think what it will be in fifty years. What will we do when we have two to three hundred people per square mile in this country? There is not likely to be any catastrophe to wipe out thousands of human lives, and we must begin to think what we will do to enable this country to maintain in comfort those people and to maintain the fertility of our soil. In doing this we are serving ourselves at the same time. No man need be afraid there is any scarcity of good improved cattle to meet the emergency. But there are entirely too many poor improved cattle, and this is the kind of cattle we can not afford to breed when our population has become so thick, nor can we afford to now. Discard the worthless and save the good stock, and that is the lesson the Shorthorn men above all others need to learn.

We have a strange superstition that every calf that comes male must be preserved for breeding purposes, while in truth there are not more than two out of five that ought to be preserved. I admit that in a way it is a tendency in the right direction. I admit there is something in the saying that "even a poor pure bred animal is better than a scrub." That is true, but we must look after the interests of the breed if we would develop it in the proper way.

We must have more steers, too, in the large stock shows. Now coming right down to our own affairs, we had the most wonderful exhibit of Shorthorns last summer, gentlemen, that I have seen in all my life. I think the exhibit at the International last December was the most magnificent display of pure bred Shorthorns the world has even seen. And yet there was not more than two or three pure bred steers there worth sending to any market. It was quite plain that practically none but the scrubs had been utilized for that class, and I think we were almost disgraced. But fortunately for us, the other breeds did not do much better. The Herefords, nor the Angus, nor the Galloways had done much better, and that saved my feelings to some extent, but I want to see the Shorthorn men get together and put their shoulders to the wheel in that particular line and show what they can do.

I cut an article out of the London Livestock Journal the other day that contained a grain of comfort to the Shorthorn men. It happened that a pure bred Shorthorn steer was the champion of the great show. It also happened that the junior champion was a pure bred Shorthorn. The champion heifer, called an Angus, had a Shorthorn sire. That is a peculiar thing which I want to say to my Angus friends. (Applause.) Last year there were fifty-two entries in the Smithfield Livestock Show. Fifty-one had Shorthorn blood on one side or the other. Whenever a Hereford man wants to produce a wonderfully good steer he takes a Shorthorn cow for its mother. Whenever you see the Hereford man getting anxious to produce an extra fine animal you see him come to the Shorthorn. (Applause.) Why? Because the Shorthorn cow has had bred into her these good qualities until they are prepotent.

Here is a little testimony from the "Argentine." This is a pamphlet published in Argentina. These gentlemen have handled four-fifths of the improved cattle that have been taken to the Argentines. Of all the European cattle represented in the Argentines the Shorthorn is the most generally favored, and the English name "Durham" is used in preference to Shorthorn. The undoubted success of this breed in that country and its value in grading the cattle of other breeds is another proof of the wonderful and unique characteristics of the Shorthorn.

That is the testimony that is communicated to us from Australia, from New Zealand and from every part of the world. Even out in the range country, where they have used Hereford bulls, because they believed the Hereford could rustle better than the Shorthorn, they find their cattle are losing scale and size and quality, and they are all resorting to Shorthorn blood in every direction to stay their declining herds. And as that country becomes more developed and worked up, they are going in more and more for Shorthorn cows everywhere.

Beside these facts, there is another thing I will mention about the Shorthorn, and I intend to object to a remark I heard another gentleman make this morning. He said we must not breed an animal for milk and beef at the same time. I don't know whether he meant an animal could not give milk and get fat at the same time, or whether we could not combine the power of production of beef and butter in the same animal. As a matter of course, when an animal is devoting its entire domestic energies to producing beef, it is not going to give a great quantity of milk, but that an animal can do both at different periods does not need any proof.

I know of two cows, one of which had made 417 pounds of butter, and the other year before last made 415 pounds and last year 416 pounds. The last cow is as fine a specimen as I ever saw. She is a Young Mary, and when she is dry she puts on flesh as rapidly as though the whole end of her existence were the butcher's block. Mr. Bates and Mr. Booth separated the two qualities, but Mr. Mason and Sir Charles .... and Mr. Knightly prided themselves upon the milking qualities of their cattle, and the beef qualities as well. It is the emasculated son that we want to develop into the great beef animal, and we want the daughter to be maternal in this function and be capable of filling any number of buckets of milk. We can do it; we must do it. The high-priced land we are sure to have throughout this country will not pay unless we have the dual purpose animal. An experiment was tried in England for four years, and concluded last year, between a herd of Jersey cattle and a herd of Shorthorns. You will find the record in the London Livestock Journal. The Jersey cattle did not pay, notwithstanding their great yield of butter. They were delicate and infertile and produced few calves. The Shorthorns did not pay as milk producers only, but the early production of their calves came to their rescue, each cow having to her credit a good yearling bullock every other year, at least. We must have one cow raising two calves and another giving milk for the creamery in order that they may be most profitable. All these things are going to be forced upon us. We will have to do this. Why, I noticed the other day that Mr. J. J. Hill made a very able speech about the first of March, and then repeated practically the same thing in Chicago. He said we were exhausting the fertility of our soil. The Americans are commencing to look to other countries to feed our population. There is no necessity for anything of the kind. All that is needed is one touch with the magic wand of good prices and intelligent agriculture and we can develop our agriculture, and the opportunity is standing before us today. Missouri is not half settled and not half farmed, let me say to you. (Applause.) I tell you there must be a change. We have a number of great big problems before us, and the biggest of all is that we shall hand down to future generations the land unimpaired. We have no right to skim the cream off of this fertile land. We must keep up the fertility. We must use intelligent rotation of crops, and graze and breed our live stock intelligently, not in the old haphazard way. I remember when I used to waste more corn than my cattle ate, and the cattle were of every sort and description. Why some of them could eat and eat and eat and not a bit of change would be noticeable in them. I remember I had one Holstein steer that I would fill up just as I would a corn crib, and he would not get a bit fatter. We must discriminate. I cannot say a word against breeding dairy cattle, and in proximity to towns, the specialized dairy cattle are of great value, and let me tell you right here that all the great dairy herds in England are Shorthorns. They are bred there for the perpetuation and development of that quality.

Why cannot some of our Shorthorn men fall in line and do in this country what they have done over there. Let us have a Declaration of Independence again. We cut loose from Great Britain in 1776 and started out to breed citizens independently of her, and now let us breed cattle independently. (Applause.)

WHY I PREFER THE ABERDEEN-ANGUS.

(Geo. Steveson, Jr., Waterville, Kansas.)

There may be some here who are not familiar with the origin of Aberdeen-Angus cattle. They are a native Scotch breed, indigenous to the northeastern districts of Scotland. There this breed originated, and there it has been brought out as one of the handsomest and most valuable of the living varieties of cattle.

From evidence obtained, the loss of horns occurred about one hundred years ago. The attention of enterprising agriculturists appears to have been directed to them about seventy years ago. The prominent qualities which attracted the attention of breeders were their quietness and docility, the easiness with which they were managed, the few losses incurred from their injuring each other, the disposing of a greater number of them in the same space, their natural fitness for feeding, and the rapidity with which they are fattened. A new ideal was formed, representing a maximum of beef and a minimum of bone, prime in quality and with little offal.

Perhaps if I briefly relate my own experience it may give you some idea why I prefer the Aberdeen-Angus. I was born and raised on the farm, and being the youngest boy, it naturally fell to my lot to herd the cattle and milk the cows while my elder brothers and father did the farm work. We afterwards moved to a small town to get better school privileges, but kept the farm.

I attended school during the winter and herded the cattle in summer, until I took a clerkship in a general merchandise store. After doing this for a few years my father and I engaged in business, at the same time feeding cattle on a nearby farm. We remained in business over a quarter of a century in the same town, and I still reside there. I relate all this to show that I had a fondness for cattle, no matter if my mind was principally taken up with the merchandise business. I sold it a little over a year ago, and now have no other regular business but the breeding and raising of Angus cattle. Some eight years ago I decided I wanted some better cattle than the average grade; in other words, some registered, purebred cattle. Living in the corn-belt, I thought I wanted the beef type, but spent more than a year investigating whether that type should be Hereford, Shorthorn or Angus. My first inclination was to purchase the Hereford, as there were so many in my county, Marshall, which I think has been styled the Herefordshire of America. This had its influence, as you know we are always prone to follow the leaders, like the sheep that finds a gap in the fence—through it goes—and the rest all follow.

At about this time I was taking the Chicago Evening Post, a general news and market paper, and in looking through the live stock notes that were not set in large, bold type, but in even smaller than the general reading type, I found these items:

"Dec. 21, 1899.—There are three distinctly beef breeds in which there is little choice. These are the Shorthorns, Herefords and Aberdeen-Angus. The Angus cattle are apt to sell the highest, and are extremely popular. They are generally considered the handsomest."

"April 16, 1900.—Thirteen black polled Angus steers, averaging 1,526 pounds, brought $6 per hundredweight today, the highest price paid in a long time. They were sold by George Adams and Burk. F. D. Moses of Wayne, Neb., fed and marketed these cattle."

"April 30, 1900.—Nelson Morris, the large packer, says: 'I am breeding the hornless Aberdeen-Angus. I am growing them on my farms in Indiana and Nebraska, and on my ranch in Texas. I have bred them for ten or twelve years, and the more I see of them the more I am convinced that they are by all odds the best beef breed. They have a larger proportion of lean to fat when ready for the market than any other. They feed more quietly and their hides are worth more because free from scratches and horn thrusts. I do not raise fancy breeding cattle for sale, but grow the best practical beef cattle. Everybody knows that horns are not only useless but a detriment. Years ago I felt this to be so and began dehorning my cattle, when I was fined $500 for cruelty to animals. Now a vast majority of the cattle that come to market are dehorned. I prefer the natural process of dehorning, which is by the use of breeds that do not have them.' "

These items and many more of same import made me think and wonder why these cattle were getting such favorable notices, and especially from the people who were engaged in the buying and selling of beef products on a large scale in the largest open markets of this country, or the world, in fact. I therefore concluded to better inform myself on my next trip to Kansas City or Chicago, and talk with the commission men, their salesmen, and others, as to why these Angus cattle were such favorites, fat or poor.

The general answer I received was that they were regarded by the packers and butchers as dressing out the highest proportion of marketable beef according to their gross weight. In addition to this, the dressed products was of the very best grade, was even and marbled. They were thickest and largest where the high-priced cuts were located, and in almost every manner were as near the butcher's type as could be found. On the other hand, they said in regard to the stocker or feeder, that they were as much the feeder type as the finished steers were the ideal butcher's type. On account of their wonderful early-maturing qualities, the greatest gain for amount of hay and grain consumed and no horns to contend with in the feed-lot, or to be discriminated against by the order buyer for the eastern cities. The Chicago Post of April 11, 1901, contained this view of the live stock market by Rappal Brothers & Co.:

"While the stocker and feeder market advanced about a dime Monday, in sympathy with beef steers, it has lost all and more of its early vigor, especially for such kinds as class below good to choice. The best is always wanted at $4.50 to $4.75, but they are the kind you seldom see. Good Angus steers would have no trouble to reach the 5-cent mark were they here."

This investigation and research decided me in favor of the Aberdeen-Angus, and I have never regretted this choice. They are still my preference, for they have kept up the high standard of their reputation, and every year, from 1899 to present time, their record has grown more brilliant with their achievements in the show-ring, open markets and slaughter tests. Facts should allay all doubt and end all controversy with you, as they did with me. For instance, at the first International Show in Chicago, 1900, the Aberdeen-Angus, in competition with the other breeds, produced a yearling steer that was grand champion, and sold in the stock yards at the public auction for $1.50 per pound, $150 per 100 pounds live weight, or a total of $2,140. The next best steer was reserve champion, which was also Angus. They won three-fourths of the prizes throughout the fat-cattle classification of this great show, including the grand champion car load of fat steers, over all breeds. They were fed and exhibited by the Hon. L. H. Kerrick of Bloomington, Ill., and sold for $15 per 100 pounds live weight. I had the pleasure of witnessing this sale, and it was the highest price ever paid for a car load of cattle on any market at that time. The same year, a month previous, A. A. Armstrong of Illinois received the grand championship award in competition with the other beef breeds for the best car load of fat steers at Pittsburg, Pa. They sold for $9.25 per 100 pounds live weight, which was $1.25 more per 100 pounds than any other carload brought. At the second International, 1901, the Aberdeen-Angus made a pretty clean sweep of it on the block, gaining the championship and four out of five awards on the 2-year-old carcass tests. At the third International, 1902, I quote from the Breeder's Gazette:

"There is no mistaking the portent. It was black year. It was a very black year. Not only did breeders of the Doddies present a memorable collection of their favorites in this section, affording some of the sharpest competition on record, but the triumphs of the Blackskins in the grades and crosses in the championships and in the car load lots seemed to invest with somewhat prophetic character our comment at the opening of the season on the approaching black cloud. In competition with all beef breeds they won grand champion on grade Angus steer, Shamrock, as the best individual fat animal of the show. Chas. Escher was awarded the grand championship on the best carload fat steers. The Angus also won the first and second prizes in the 2-year-old slaughter test; also first prize in the yearling test."

At the fifth International Show, 1904, it was Angus year again. If Clear Lake Jute 2d, who was reserve champion the year before, came back and demonstrated, he should have been first and reserve in 1903. C. Krambeck, Marne, Ia., was there with a car load of fat Doddies that won highest honors over all breeds, and also demonstrated that he should not have been technically protested the year before when all conceded he had the grand champion car load. Messrs. Kerrick and Funk, each with a load of Angus, were close contestants for this award.

The sixth International, 1905, was history repeating itself. It was Angus again. "Blackrock" grade Aberdeen-Angus steer was made grand champion over all individual fat steers. C. Krambeck was there again, and still more forcibly demonstrated that he was a feeder and a breeder of the right sort, by being awarded the grand championship over all breeds for the best car-load of fat steers, An Angus steer was again champion in the dressed carcass test.

The account of the fat car-load at the last International Show of last month, as published by the Breeders' Gazette, is strong enough to make anyone unprejudiced appreciate the greatness of Angus cattle. The first four car-loads contesting for grand championship honors were Angus. Such a quartette of carloads of finished beef was never before under the critical eye of a judge. A load of Angus steers was awarded grand championship. This was a foregone conclusion even to the layman surveying the exhibit. The Funk car-load first, the Krambeck second, the Kerrick third, the Escher fourth, making a constellation of Angus steers the like of which had never been presented to the public before.

The champion slaughter test was won by an Angus 2-year-old steer. The Daily Drovers' Telegram, Kansas City, Mo., April 26, 1901, contained this article:

"To say of a breed of beef cattle that it has topped our markets in car-load lots for eleven successive years comprehends a great deal to the man that is raising cattle. The end and aim of all breeds of beef cattle is the butcher's block, and the breed that dresses the highest per cent is the breed that appeals to the cattle raiser."

This statement was made and can be proven to the Aberdeen-Angus breed. This you note was published in 1901. They have done so every year since that time, and now it is seventeen years, and they topped the market at the last International at $17.00 per 100 pounds, live weight, the highest price that a car-load of cattle ever sold for in Chicago. Nor are their winnings confined to this country, for they won the London Smith field show, wich is the International of the British Isles.

The Angus breed for the year 1906 made the most imposing section of the show. The record of this great beef breed at this London show is nothing short of marvelous, for prior to this year's show, over a period of fifteen years, the breed has produced a grand champion on no fewer than seven occasions, which is quite a remarkable feat, when the many different breeds of cattle comprised in the inter-breed competitions which take place at Britians leading show are considered. At the 1903 Birmingham Show, England, out of four classes, Aberdeen crosses won all the first prizes, three out of four prizes, all of the third prizes, besides an extra prize of thirty pounds for the best cross bred. Therefore, the Angus won eleven out of the twelve prizes. Truly a flattering illustration of the potency of the Aberdeen-Angus, when mated with the other breeds.

Now, doesn't this strike you as being significant—topped the market in car-lots for seventeen years without a break, nearly always furnishing the grand champion car-load and single fat steer in open competition; and that, too, when there were proportionately 100 head of the other breeds to one of the Angus from which to select these prize winners, the Angus being comparatively a new breed in this country, the first importation being less than thirty years ago?

I hope I have made myself understood as to the market topping qualities of the Angus cattle. And now I wish to say something of horns, or rather no horns. Other things being equal, isn't it much better to have no horns? I remember well the first winter I kept my pure-bred herd. Many times before retiring for the night I would take the lantern and go out to see that they were all under shelter, especially so when there was a hard storm or blizzard. It was a board shed open to the south, and invariably I would find them lying down close together like a flock of sheep, chewing their cud and apparently unmindful of the storm or cold. My experience in caring for horned cattle was that there would be several in the lot that were bosses, and would assert their authority by taking possession of nearly all, if not quite, the one side of the roughness rack, the feed box and a majority of the space under the shed. All of these conditions meant expense to me, and because of the loss in gain from the unrest and the grain and hay fed to them.

Then, again, if you are fattening them for the open market, you are discriminated against 25 cents per 100 pounds on account of your stock having horns. The eastern order buyer does not want them for his customers in the large eastern cities; hence you lose the competition, and about your only market is the local packer. Late years some get around this horn proposition by dehorning, but that is troublesome, expensive, and, besides, not nature's way, and in this busy world it is easy to neglect it. Then you might be justified in handling horned cattle if they were so much superior in every way to the Angus except the disagreeable horns. But are they? Do the competitive awards bear us out in this deduction? Do the price they sell for fat or lean in the largest live stock markets in the world justify our belief? Think it over. Here is what Rappel Brothers & Co. say, who are one of the leading firms at the Chicago yards:

March 22, 1901.

"A bit of advice that can be acted on with good benefits is to beware of all horned cattle without getting liberal margins, for as the days wear on when this class of stock becomes less noticeable, buyers fear them most on account of the bruises, etc., which detract doubly from their value in the carcass, and therefore ignore them entirely, unless at prices that are low enough to insure against all possible loss. At least 15 to 25 cents on natives and 20 to 40 cents on westerns is not too much reduction to make in comparison with those which are dehorned, for that is about the ratio of discrimination which buyers are making."

Secretary Coburn, in his report for 1902, says: "It is estimated by those who have paid most attention to such statistics that not less than 200 persons in the United States each year are seriously injured by cattle horns; and that by the same means a hundred thousand cattle, horses and colts and innumerable sheep and swine are annually destroyed. That two-thirds or three-fourths of all the tremendous losses by abortion, especially among cows, if carefully investigated, could directly or indirectly be traced to the presence of horns."

Converted into dollars and cents, the foregoing represents truly an enormous sum. I tsometimes think we agriculturists and stockmen are a slow lot. We just go along breeding a certain kind of cattle because our grandfather, it was said, had some grades of that breed. Then we come to the father. He had a bull or a cow that could have had the papers if he asked for them, and then on down to the son, who makes up his mind to get some pure-bred stock, and without investigating, says the same kind is good enough for me that was good enough for dad and grandpap. The same applies to improved methods of farming, etc.; therefore, I repeat, are we slow and heedless?

In conclusion, I wish to state that it took considerable time and investigation before I became convinced of the superior merits of the Aberdeen-Angus cattle. I do not want to leave the impression with you that I am prejudiced and cannot see the good qualities in any of the other breeds. I delight in viewing a first-class animal of any of the other kinds, and shall cultivate that disposition, always striving to be broad-minded enough to give credit where credit is due. The other beef breeds are being conformed to the Angus type, which is a hardy, low down, hornless animal, that will take on more flesh for the same number of pounds of feed in a shorter space of time, will be smoother, evener, more uniform, take excellent care of their calves, and the butcher's delight when on the hooks in his market.

Then why not be an Angus breeder, for life is all too short to waste time and labor experimenting to bring about that which is already here.

MAINTAINING SOIL FERTILITY IN SYSTEMS OF PERMANENT AGRICULTURE.

(Dr. C. G. Hopkins, Experiment Station, Urbana, Ill.)

To permanently maintain profitable systems of agriculture is the most important material problem of the United States, because every other important industry in America depends upon agriculture for support. Every form of agriculture rests, first of all, upon the fertility of the soil, whether it be grain farming, fruit growing, market gardening, or live stock husbandry.

In our present prosperity and abundance we almost forget the latest famine in Russia; can scarcely realize that much of the time more people are hungry in India than live in the United States; and will not remember tomorrow President Roosevelt's call of today for help to relieve the wide-spread famine now existing in China. Meanwhile we go on, as a people, ignorantly, carelessly or wantonly robbing our soil of its fertility and American posterity of a rightful heritage.

Among all the nations of the earth, the United States stands first in rapidity of soil exhaustion. The improvement of seed, the use of tile-drainage, the invention and immediate adoption of labor-saving agricultural machinery, the wonderful development of cheap and rapid means of transportation, and the opening of the world's markets to the American farmer have all combined to make possible and to encourage the rapid depletion of American soils; until practical agricultural ruin already exists over vast areas in the older parts of these United States, while it is common knowledge even in the new rich states of the central west that the lands that have been under cultivation for half or three-quarters of a century are much less productive now than they once were.

Farm manure always has been, and without doubt always will be, the principal material used in maintaining the fertility of the soil; but it is an unquestionable fact that the greatest source of loss to American agriculture today is in the enormous waste of farm manure.

If corn were worth $1.05 a bushel, then the average annual value of the corn crop of the United States for the past ten years, including 1906, would be equal to the average value of the total farm manure annually produced in this country. This statement is based upon the careful estimates of the United States Department of Agriculture, placing the average annual corn crop at nearly two and one fourth billion bushels, and the average value of the manure annually produced from 20 million horses and mules, 61 million cattle, 47 million hogs and 52 million sheep, at more than two and one-third billion dollars.

The evidence is sufficient to fully justify the conclusion, and practical observing farmers will all agree that at least one-third of the manure produced is wasted on the average American farm. If this is true, then the total value per annum of all commercial fertilizers used in the United States (amounting to about 75 million dollars) is equal to only one-tenth of the annual waste of farm manure. This is no argument against the intelligent and profitable use of commercial plant food by those who make and save and use farm manure to the greatest possible practicable extent, but it serves only to emphasize the tremendous loss to the country from the waste that is permitted.

The value of farm manure can be, and has been, determined by two entirely different methods:

First, the manure may be analyzed chemically to ascertain the kinds and amounts of plant food it contains and its value then computed from the cost of the same amounts of these plant food elements if purchased in the world's markets in commercial form.

Second, the manure may be applied to the land in a series of soil experiments where a suitable crop rotation is practiced, and its value determined by computing from the value of the increase which it produces in the different crops.

The amount of plant food contained in a ton of farm manure varies considerably and depends largely upon four important factors, which are probably correctly ranked in the following order:

1. The condition as to dryness.
2. The kind of feed and bedding.
3. The state of preservation.
4. The kind of live stock.

The plant food in a ton of manure varies with the dry matter content. Thus, manure containing 85 per cent of water, is only half as rich in plant food as the same manure after the water content has been reduced by evaporation to 70 per cent. This may seem impossible at first thought, but a careful consideration will show that it is true. If the manure contains 85 per cent of water, it can contain only 15 per cent of dry matter; whereas manure containing only 70 per cent of water must contain 30 per cent of dry matter. Very erroneous conclusions are frequently drawn regarding the comparative value of different manures because of apparently small or moderate differences in water content. Average fresh mixed cattle and horse manure with an ordinary amount of litter, or bedding, contains about 75 per cent of water and 25 per cent of dry matter. Thus, a ton of such manure contains 500 pounds of dry matter and 1,500 pounds of water.

The plant food in a ton of manure varies greatly with the materials used for feed and bedding. Thus, wheat straw contains per ton about 10 pounds of nitrogen, 2 pounds of phosphorus and 17 pounds of potassium; while clover hay contains about 40, 5 and 30 pounds respectively of nitrogen, phosphorus and potassium. At 12 cents a pound for nitrogen, 12 cents for phosphorus and 6 cents for potassium, the value of these elements is $2.76 in a ton of wheat straw, $5.40 in timothy hay, $8.40 in clover hay and $9.42 in a ton of alfalfa hay.

The following facts may well be kept in mind:

1. In grain crops about two-thirds of the nitrogen, three-fourths of the phosphorus and one-fourth of the posassium rerequired for the crop will be contained in the grain, while about one-third of the nitrogen, one-fourth of the phosphorus and three-fourths of the potassium required for the crop will be found in the straw of stalks.

2. In nitrogen and phosphorus clover and other legume crops are about as rich as grains, nearly twice as rich as timothy or red top, and more than twice as rich as straw or stalks.

From these facts it becomes very plain that the quality of richness of manure must depend very largely upon the kind of feed used.

The plant food in a ton of maunre varies greatly with the exposure it has suffered under the weather conditions.

If ordinary fresh farm manure contains 10 pounds of nitrogen, 2 pounds of phosphorus and 10 pounds of potassium per ton of manure with a dry matter basis of 25 per cent (and 75 per cent water), the manure that will result from holding such fresh manure until it becomes more or less rotted will vary greatly in composition, depending upon the conditions to which it is subjected. If the fresh manure is exposed for a few weeks to the leaching of heavy rains, half of the nitrogen and potassium may be leached out, while smaller losses of phosphorus and dry matter occur, so that a ton of the resulting manure, in which the urine (which usually contains about half of the nitrogen and potassium) has been replaced by rain water, may contain only 6 pounds of nitrogen, 2 pounds of phosphorous and 6 pounds of potassium. The difference of 4 pounds each of nitrogen and potassium does not represent the total loss, because if the pile contained 10 tons of fresh manure, there will be left perhaps only 8 tons of the leached manure, even with the same percentages of dry matter and water.

If, however, the pile of manure suffers less from leaching but more from fermentation and heating for several months, the loss of dry matter or total weight will be great and the loss of nitrogen considerable, while the loss of phosphorus and potassium will be less. Thus, after six months of such conditions, the 10 tons of manure, with 100 pounds of nitrogen, 20 pounds of phosphorus and 100 pounds of potassium, may be reduced to 5 tons of manure, containing 60 pounds of nitrogen, 18 pounds of phosphorus and 80 pounds of potassium. This rotted manure (with the same per cent of dry matter as the fresh) would contain in one ton 12 pounds of nitrogen, 3.6 pounds of phosphorus and 16 pounds of potassium. Rotted manure produced in this way is usually richer per ton than fresh manure, but the total amount of manure has been so reduced that the actual loss is very great.

These simple principles should be kept in mind:

1. In leaching fresh manure there are great losses of nitrogen and potassium and moderate losses of phosphorus and organic matter, the materials lost being carried away in the leach water.

2. In fermentation and heating there are great losses of nitrogen and organic matter in volatile products which escape into the air, but if no leaching occurs there is no loss of phosphorous or potassium.

In an exact experiment conducted at Cornell University, 4,000 pounds of ordinary manure from the horse stable, worth $2.74 per ton for the plant food it contained, were exposed in a pile out of doors from April 25 to September 22 (less than five months), but at the end of that time the total weight had decreased to 1,730 pounds, and that was worth only $2.34 per ton. In other words, the value of this pile of manure was reduced from $5.48 to $2.03 during five months' exposure. In another experiment, manure exposed for six months lost 56 per cent. of its dry matter and 43 per cent. of its plant food value. In this case the fresh manure was worth $2.27 a ton, while the rotted manure was worth $3.01 a ton, but the loss in total weight and in plant food was such that for each ton originally worth $2.27 there remained only $1.30 worth after six months' exposure.

The plant food in a ton of manure varies somewhat with the kind of live stock. Thus, young, growing animals and animals giving milk will retain a larger proportion of the nitrogen and phosphorous than fattening stock, work horses, or other mature animals. On the other hand, it is well to understand that the differences in value commonly recognized and most frequently considered, as, for example, between sheep manure and cattle manure, are due almost entirely to differences in water content. As a matter of fact, manure from work horses or from fattening steers fed on clover hay and heavy grain rations is fully as rich and valuable as sheep manure, if both are reduced to the same percentage of dry matter. Of course, sheep manure, containing only

60 per cent. of water, is twice as rich as cattle manure containing 80 per cent. of water.

The information given above, based upon the records of chemical investigations, will enable one easily to understand and appreciate the scientific and practical reasons for avoiding some methods and for adopting other methods for handling farm manure.

Average moderately fresh cattle or horse manure, made from clover and timothy hay and some grain, with sufficient straw bedding to absorb and retain the liquid manure, will contain per ton of manure about 10 pounds of nitrogen, 2 pounds of phosphorous and 10 pounds of potassium, on the basis of 25 per cent of dry matter. Computed at the present market values for these elements—15 cents a pound for nitrogen, 12 cents for phosphorous and 6 cents for potassium—such manure would be valued at $2.34 a ton.

Some will argue that the plant food in farm manure is not so readily available, and consequently should not be valued so highly as that in commercial forms, but experiments show that when a series of years is considered, the farm manure may be worth about as much as the commercial materials on the basis of plant food content. Thus, at the Rothamsted Experiment Station, an application of 14 tons of farm manure, furnishing, according to the above averages, about 140 pounds of nitrogen, 28 pounds of phosphorous and 140 pounds of potassium per acre per annum, has maintained the yield of wheat at 35.6 bushels per acre, as an average of 50 years; while an average yield of 36.9 bushels has been maintained during the same years by an application of commercial plant food furnishing 129 pounds of nitrogen, 27 pounds of phosphorous and 84 pounds of potassium per acre per annum.

If we disregard potassium (which is not very important, because of the richness of Rothamsted soil in that element), the amounts of plant food applied and the average yields produced during half a century are not markedly different. The yield of the fertilized plot averages 1.3 bushels higher during the fifty years, but .7 bushel lower during the last ten years, than the manured plot.

It is a very common and very erroneous belief that crop rotation produces about the same effect as the application of farm manure.

The great difference between these two processes is that crop rotation is a stimulant and ultimately reduces the fertility of the soil to such a degree that the crops fail, especially the crops that have the most stimulating effect, as clover; whereas, by the addition of farm manure, there is a positive addition to the soil of the materials of which crops are made, so that with sufficient manure the soil may be made richer and richer for an indefinite length of time.

The only element of plant food that can be added to the soil by crop rotations is nitrogen, which can be secured from the air by clover and other legume crops.

It should be understood, however, that the most marked and most common effect produced by clover, by which increased yields of succeeding crops are secured, is not due largely or primarily to the addition of nitrogen, but rather to the power of clover to liberate mineral plant food from the soil for the use of the following crops.

This process may be continued successfully until the supply of phosphorus (or of potassium, in some cases) becomes so reduced that even the strong-feeding clover plant cannot secure enough phosphorus for its own growth. When this condition arrives the clover crop begins to fail, and the only recourse is to begin to return the exhausted plant food. It may be returned in bone meal, in raw rock phosphate, or in sufficient amounts of farm manure. Indeed, the most marked and beneficial effect of farm manure is often seen when it is applied for the clover crop. This fact alone, which is a common observation, is sufficient to show that farm manure has a value not possessed by clover or by crop rotations.

We should not discourage the rotation of crops, because crop rotation helps us to grow larger crops, and to be successful in farming requires that large crops shall be grown, even though correspondingly large amounts of plant food are removed from the soil.

On the other hand, we should plan always to return in some form the kind or kinds of plant food that are becoming deficient in the soil.

Let us consider in further detail the effect of crop rotation upon soil fertility. Suppose we are practicing a four-year rotation, including corn for two years, oats with clover seeding the third year, and clover for hay and seed crops the fourth year. Let us assume such crop yields as have been produced, and as can be produced, in normal seasons on the richest, best-treated land with good seed and good farming; namely, 100 bushels of corn per acre, 100 bushels of oats and 4 tons per acre of clover, including perhaps 3 tons in the hay crop and 1 ton in the seed crop. If we do not succeed in securing these yields, we should at least try to make such yields possible, and we should approach as near to them as we can.

Let us first consider the phosphorus required for this rotation. The two crops of corn will each require 23 pounds, 17 for the grain and 6 for the stalks; the oat crop will require at least 15 pounds of phosphorus, about 11 for the grain and 4 for the straw; and the 4-ton crop of clover will require 20 pounds of phosphorous. Thus we see that 81 pounds of the element phosphorus will be required for the rotation. If we leave the stalks on the land the requirement is reduced to 69 pounds of phosphorus, or to about 17 pounds a year.

Suppose the soil contains in the first 7 inches 1,200 pounds of phosphorus per acre, which is about the average of the principal type of soil in the Illinois corn belt, how many years would be required to remove this amount from the land if it could be drawn upon at this rate? Only seventy years. On the other hand, suppose with this crop rotation we can secure from the soil the equivalent of only one per cent of the phosphorus contained in the first 7 inches. This would be only 12 pounds of phosphorus a year, which would necessarily reduce the crop yields to about one-half the amounts suggested above, and with the further reduction in the total amount of phosphorus year by year, the crop yields must be reduced accordingly.

Ultimate failure is the only future for this system of farming, even if we consider the phosphorus alone; although, as stated above, the phosphorus may be returned in bone meal, in rock phosphate or in farm manure.

If we consider the element nitrogen in this system of farming, we find that 200 bushels of corn require about 200 pounds of nitrogen, aside from that required for the stalks, which must be returned to the land without burning, otherwise the 96 pounds of nitrogen required for the two crops of stalks will also be removed from the land. The oats crop will remove 90 pounds of nitrogen, making 290 pounds for the corn and the oats.

The four tons of clover will contain about 160 pounds of nitrogen, and the clover roots and stubble about one-half as much as the tops, or 80 pounds per acre. If all of the nitrogen contained in the entire clover crop is taken from the air, the rotation would add only 80 pounds of nitrogen to the soil, while the corn and oats would remove 290 pounds.

How then is it possible to maintain the supply of nitrogen by this rotation? It is not possible. Under such a rotation, with all crops removed except the corn stalks, the supply of nitrogen grows less and less. Where this rotation is successful for a time it is due to the fact that the soil nitrogen has been drawn upon year by year while the chief effect of the clover has been to extract phosphorus from the soil for its own growth and for the use of succeeding crops.

There is another point to be considered in reference to nitrogen. On land that is capable of furnishing sufficient nitrogen for even a 50-bushel crop of corn, the clover crop will undoubtedly draw a third of its nitrogen from the soil and not more than two-thirds from the air. Consequently, since two-thirds of the nitrogen in the entire plant is removed in the tops, the roots and stubble will leave no more nitrogen in the soil than the plant takes from the soil. How then can we maintain the supply of nitrogen in the soil? By plowing under clover or applying farm manure, or by both of these means.

If all the crops grown in the rotation are fed, including the corn stalks, containing a total of 526 pounds of nitrogen from four acres, and if three-fourths of this, or 395 pounds, are returned in the manure, we have sufficient to replace the 386 pounds removed in the corn and oat crops, and we may assume that the 160 pounds removed in the clover came from the air. Of course, some additional nitrogen will be saved in the straw and stalks which are used for bedding, as compared with the crops fed.

How shall the grain farmer maintain the nitrogen in his soil? Possibly this can be done by growing an additional legume catch crop in the corn and plowing under everything produced except the grains and the clover seed, preferably only one corn crop being grown in the rotation.

The problem of maintaining the nitrogen becomes easier if we extend the rotation to include about two ears of pasture, using a mixture of red clover, alsike, timothy and red top, instead of seeding red clover, only, with the oats. In this case three-grain crops, as corn, oats and wheat, or corn two years and oats one year, could be grown during the six-year rotation, the farm being divided into six different fields.

In England and in other progressive agricultural countries of Europe the value of feeding stuffs is commonly figured in two ways: First, for the feeding value; and second, for the fertilizing value of the manure produced.

Among the most successful and up to-date farmers in this country these two values are also carefully considered.

It is one thing to say that farm manure has a value, but quite another thing to say what that value is or to what it is due.

The positive or intrinsic value of farm manure lies in the amounts of valuable plant food which it contains. It also possesses an important indirect value as a soil stimulant, due to its power, as it ferments and decays in contact with the soil, to liberate from the soil plant food that would not otherwise become availabe so quickly. There is still another distinct value in farm manure due to the fact that it makes the soil more porous and spongy, and thus increases the power of the soil to absorb and retain moisture and to resist surface washing. In other words, this third value of farm manure is due to improvement in physical condition.

The value of farm manure for its physical improvement of the soil is commonly fully appreciated and frequently even overestimated by popular agricultural writers, while its value for the plant food which it supplies and for that which it liberates from the soil is sometimes almost ignored.

There is no good excuse for erroneous teaching regarding these different values, because there exists a vast amount of positive information, both from practical experience and from exact scientific investigations.

Thus, organic matter from peat beds hauled out and spread on the land and incorporated with the soil produces no such effects on crop yields as are produced by good farm manure. Why? Because the peat does not decay readily so as to furnish plant food, either by its own decomposition or by liberating it from the soil; and yet the peat has as great power as farm manure for physical improvement of the soil.

Manure made from clover hay and heavy grain rations has much greater value than manure made from wheat straw. Why? Is it because they affect the physical condition of the soil in different ways? No. The great difference in value is due to the difference in plant food and in rapidity of decay.

At the famous Agricultural Experiment Station at Rothamsted, England, on a field to which no manure and no plant food have been applied, the average yield of wheat has been 13.1 bushels per acre for more than half a century.

Land treated with a heavy annual application of farm manure has produced 35.7 bushels of wheat per acre as an average of 51 years. Another field treated with commercial plant food, without organic matter, has produced 37.1 bushels of wheat per acre as an average during the same time. The latter field received a little less plant food than was furnished in the manure, thus furnishing ample proof of the value of plant food supplied in manure, and showing that the physical effect of the farm manure was by no means so important. Nevertheless, the physical effect should not be overlooked. Under certain seasonal conditions this physical value may be very important. Thus, in the very dry season of 1893, the land fertilized with commercial plant food produced only 21.7 bushels of wheat per acre, while the farm manure plot produced 34.2 bushels the same year.

In semi-arid regions the physical condition of the soil and its power to absorb and retain moisture may be the controlling factor in crop yields, but where the average annual rainfall is 28.21 inches (as at Rothamsted), or 37.39 inches (as in Illinois), with a fairly uniform distribution during the growing season, the physical conditions of the soil in relation to crop yields may be compared to the shelter and other physical surroundings provided for live stock. In other words, under normal conditions the controlling factor is food for crops as well as for live stock.

While manure has some value for physical improvement and a larger value for its power to liberate plant food from the soil, it should be clearly understood and always borne in mind that the great value of farm manure, especially in profitable systems of permanent agriculture, is due to the plant food it contains, and that the greatest problem in the handling of farm manure is to prevent the loss of plant food.

The value of average fresh farm manure is about $2.25 a ton, either when determined by chemical analysis on the basis of market values for the plant food contained in the manure, or when determined by the value of the increased crop yields produced when the manure is applied to the fields in ordinary crop rotations.

This means that a pile of average fresh farm manure, containing 100 tons, is worth about $225. If exposed to leaching from heavy rains during only two or three months in the spring, the value will be reduced, as a rule, from $225 to about $150 by the loss of plant food, without much reduction in total weight. Indeed, the total weight is frequently increased under such conditions because the rain water that remains in the manure may be in greater amount than the urine that has been washed out. Fermentation and additional leaching during the summer may easily reduce the value to $100 or less.

There are two satisfactory methods for handling manure: One of these is to haul and spread the fresh manure daily, or at least two or three times a week. For this purpose a manure spreader, or at least a wagon used for this work only, is very useful and almost necessary.

The other method is to allow the manure to accumulate in the stall or covered feeding shed while it is constantly tramped by the animals and kept moist by the liquid excrement, sufficient bedding being used to absorb the excess and to keep the stock clean, and then to haul and spread it on the land when conditions permit. It should not be left, however, to dry out and heat and decompose in the stalls or sheds long after the animals have been turned out to pasture.

Every system of farming should be so planned as to be both profitable and permanent, which requires that the productive capacity of the land must be maintained. We must understand then what the soil contains, what materials are required to produce crops, in which parts of the crops these different materials are deposited, so as to know what part of the produce may be sold off the farm and what should be retained; and also what is done with these important materials when the crops are fed to live stock.

The older prairie and timber soils of the states of the Central West are exceedingly rich in potassium, but deficient in both nitrogen and phosphorus. In the worn hill lands nitrogen is usually more deficient than prosphorus, while in the average long-cultivated prairie soil phosphorus is more deficient than nitrogen.

When grain crops are produced, as corn, oats and wheat, about two-thirds of the nitrogen and three-fourths of the phosphorus, but only one-fourth of the potassium required for the crop are stored in the grain or seed; while about one-third of the nitrogen, one-fourth of the phosphorus and three-fourths of the potassium are stored in the straw or stalks.

Thus a large crop of corn (100 bushels to the acre) will contain about 100 pounds of nitrogen in the grain and 48 pounds in the stalks; 17 pounds of phosphorus in the grain and 6 pounds in the stalks; 19 pounds of potassium in the grain and 52 pounds in the stalks. Quite similar relations exist between the grain and straw of other crops.

Now, with these facts in mind, it is plain to see that a system of farming in which the grain is sold and only the stalks and straw are kept on the farm and returned to the soil carries off in the grain much of the nitrogen and phosphorus, in both of which these soils are more or less deficient, and which should be returned to the land; while the potassium, of which the soil contains an inexhaustible supply, is largely returned in the straw and stalks.

It should be remembered that legume crops, as clover, cowpeas and soy beans, are rich in both nitrogen and phosphorous, three and one-half tons of clover hay containing as much phosphorus and 40 pounds more nitrogen than 100 bushels of corn.

If the crops are fed to live stock, it is well to know that about one-fourth of the nitrogen and one-fourth of the phosphorus are retained in the flesh and bone of the animal, while three-fourths of the nitrogen and phosphorus and practically all of the potassium are returned in the solid and liquid manure.

Thus we have another process of separation by which part of the needed nitrogen and phosphorus leaves the farm with the animals, while the potassium is again returned, even though it may not be needed.

It should be a plain fact that manure made from animal excrements with straw or stalks for bedding must be deficient in nitrogen and phosphorus, but well supplied with potassium.

In the case of nitrogen, the difficulty can be overcome by making a liberal use of clover or other legumes in the crop rotation and as catch crops, turning under these crops and crop residues so far as practicable. Legume crops may also be used in pastures to a considerable extent, and in three different ways it is possible to secure sufficient nitrogen from the air to balance the deficiency in the manure.

With the phosphorus the difficulty is greater, because the proportion contained in the manure is less, and there is no such ever-present inexhaustible supply as in the case of nitrogen.

It must be apparent that to increase the value of farm manure we should add phosphorus to it. Thus we can balance manure, and when used on soil rich in potassium in rotations with nitrogen-fixing legume crops, we can provide plant food in a balanced ration to meet the needs of the maximum crop yields. By these means we can check the progress of soil exhaustion and even gradually increase the fertility and productive capacity of the land. Indeed, we can thus profitably enrich such land even beyond its virgin fertility.

By far the cheapest form of phosphorus is fine-ground raw rock phosphate. This material is but slightly available for the use of crops if applied to soils deficient in decaying organic matter; but if applied in intimate connection with rotting manure, it is thus made soluble and available for plant growth.

Certainly one of the most profitable, and probably the very most profitable, method of maintaining the necessary supply of phosphorus in the soil is to put back into the manure, in the form of fine-ground raw rock phosphate, somewhat larger amounts of phosphorus than the animal has retained in his bones. It is well, for a time at least, to put back larger amounts than the animals retain, because the soils are already deficient in phosphorus, and also because there may be some waste of manure.

These statements are based both upon the chemical analysis of soils and crops and manures, and also upon carefully conducted field experiments covering many years.

The Maryland Experiment Station furnishes some valuable data from probably the earliest systematic investigations, still being continued, and a large amount of information is rapidly accumulating from our more extensive work in Illinois, but the most complete experiments of long duration are reported by the Ohio Experiment Station. Where 40 pounds of fine-ground rock phosphate, costing about 16 cents, were added to each ton of manure and 8 tons of manure per acre were applied for a three-year rotation of corn, wheat and clover, the value of the increase in crop yields was equal to $2.66 for each ton of manure used, in case of yard manure (which was worth only $1.64 per ton without the phosphate); and, in case of the stall manure, its value was increased from $2.22 a ton to $3.42, by the addition of the 16 cents worth of rock phosphate, these results being the average of nine years' experiments on three different series of plots, based upon increased yields, valued at 35 cents a bushel for corn, 70 cents for wheat and $6.00 a ton for clover hay.

If we deduct the cost of the phosphate used, we still have what might be termed a net value of $2.50 for the phosphated yard manure and $3.24 a ton for the phosphated stall manure.

Of course, it would be equally appropriate, and possibly more so, to speak of "manured phosphate" instead of "phosphated manure," because the rock phosphate actually furnishes the needed and deficient element, phosphorus, while the manure helps to make it available. On this basis we may say that the value of 40 pounds of rock phosphate is increased from 16 cents to $1.02 by mixing with a ton of yard manure, and from 16 cents to $1.20 by mixing with a ton of stall manure, after deducting the value of the untreated manure in each case.

The most important fact to keep in mind, however, is that both the manure and rock phosphate are much more valuable when used together than when used separately, because manure is deficient in phosphorus and rock phosphate does not act except in connection with rotting organic matter. As a rule, it is better to use from 50 to 100 pounds of rock phosphate with each ton of manure.

There are two very satisfactory methods of mixing the rock phosphate with the manure. One is to sprinkle the phosphate over the manure from day to day as it is being made in the stall or covered shed. The other method is to fill the spreader box part full of manure, then sprinkle phosphate over it sufficient for the load, finish loading with manure, and drive to the field and spread. This produces an intimate mixture and a very uniform distribution, and requires practically no extra work to get the phosphate spread on the land. Care should be taken that the manure is not too dry when the phosphate is sprinkled over the load, otherwise the dry rock dust may get into the gearing or bearings of the spreader and cause them to wear rapidly.

There are some extraordinary or abnormal soils. Thus, there are soils exceedingly rich in nitrogen and well supplied with phosphorus, but very deficient in potassium; as, for example, certain peaty swamp soils on which the application of potassium produces an increase in the corn crop usually amounting to more than 30 bushels per acre, and on which Illinois farmers are already using about twenty thousand dollars' worth of concentrated potassium salts annually, and with a net profit of more than 200 per cent.

There are soils exceedingly rich in phosphorus and well supplied with potassium, but deficient only in the element nitrogen, and which require only a liberal use of legume crops to be turned under as green manures or returned to the soil as stable manure in order to render them highly productive and profitable soils. Abnormal soils of this class exist in considerable areas in the geologic neighborhood of phosphate regions, as in certain sections of Tennessee and Southern Kentucky. Indeed, some of these soils contain twenty times as much phosphorus as the average Illinois corn-belt soil.

But, when we consider the ordinary, normal upland timber and prairie soils, covering the vast areas of the Central West, the so-called "granary of the world"—soils of glacial and loessial formation and of granitic origin, there are two substances always to be kept in mind and always to be provided in abundance, for any and every system of permanent agriculture to be practiced on these soils. These two essential substances are phosphorus and decaying organic matter, which will, of course, also supply the nitrogen.

It is not of great consequence by what methods or in what forms these materials are supplied. Phosphorus may be purchased in grain, or in other concentrated foodstuffs, to be fed with clover hay, it may be, and then applied to the soil in the form of farm manure; or phosphorus may be applied in the form of bone meal, which is also a farm product, or it may be obtained from the great phosphate mines of our Southern States, as we obtain coal from our own extensive mineral deposits.

The decaying organic matter may be supplied in farm manure, or in sufficient quantities of legume crops, not harvested and removed from the land, but turned under as green manures, including the use of rotation pastures, or still better and more easily, and usually more profitably, by a combination of these methods.

But there can be no permanent agriculture for these soils by any system under which the phosphorus is removed and sold in grain and bone in larger amounts than are returned to the soil, nor under any system by which the organic matter of the soil is worn out or destroyed more rapidly than it is replaced.

On the other hand, systems of permanent agriculture for these soils are not only possible, but they are more profitable than any system under which the soil grows less productive.

ANIMAL HUSBANDRY AND SOIL FERTILITY.

(C. E. Thorne, Director Ohio Experiment Station, Wooster, Ohio.)

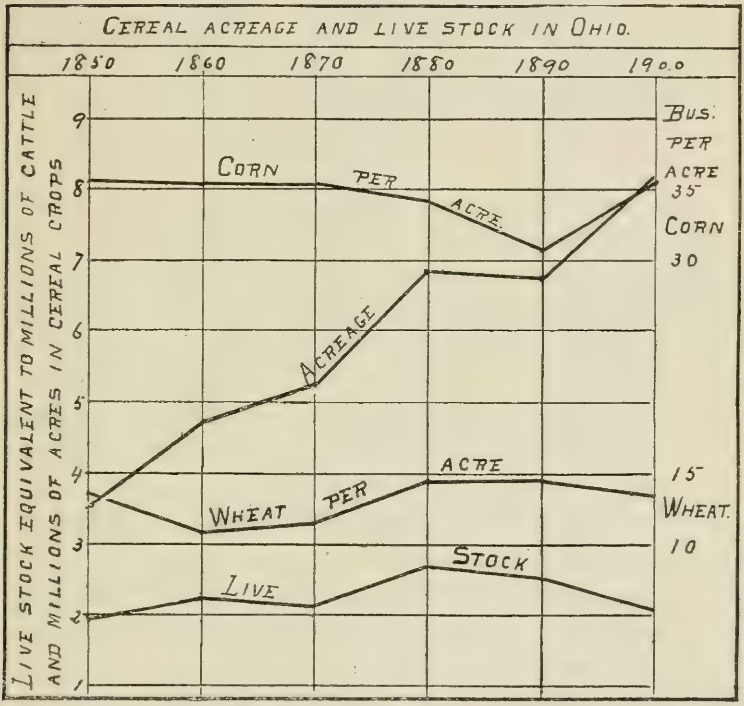
Mr. Chairman and Gentlemen: I konw that many of you are tired and that some of you, at least, have errands outside that must be attended to, so you will not offend me by leaving if you desire to do so.

I had the pleasure of speaking to this audience a year ago on practically the same subject with which I come to you again, and if I should offer an apology for coming back the second time with the same subject, it would be the one that Dr. Hopkins has already given you, that upon the soil rests all industry, and that the maintenance of the fertility of the soil is the fundamental problem in agriculture.

A year ago Professor King, in his address to you, called attention to the fact that, notwithstanding our greater knowledge of the soil and its management notwithstanding our vastly improved methods of tillage and husbandry, today we are producing no greater yields of corn and wheat than we did fifty years ago; and this notwithstanding that in addition to the facts before enumerated, we have resorted to a large use of new sources of fertility—the commercial fertilizers.

I have in my own State taken the statistics of crop production, which have been kept for a little more than half a century, and I have compiled these statistics for every county in the State for 50 years, both as to crop production and as to animal husbandry, and a graphic summary of these I put before you in chart I:

CHART_I.



In 1850 we were keeping the equivalent of nearly two million cattle in the State, if we count two sheep or hogs equal to one head of cattle in manure production. We were cultivating about three and a half million acres in cereal crops, or less than two acres to each cattle beast. At that time very little grain was sold off the farm except wheat, the corn being practically all fed out at home.

During the next thirty years our acreage in cereals rose to nearly seven million acres, and our live stock population to the equivalent of about two and three-fourths million cattle, or a little more than two and one-half acres in cereals to each cattle beast.

For the last twenty-five years our cereal production has continued to increase, but with the development of the great range industry of the West and the low prices consequent, which prevailed during the eighties, our animal population not only failed to make any further increase but began to fall off, so that we began the new century with but few more animals on our Ohio farms than we had at the middle of the century previous, while our area in cereal crops had increased to more than eight million acres, giving four acres in cereals for every cattle beast kept.

About the middle of this period we began the use of commercial fertilizers. At the beginning of the eighties we were expending three or four hundred thousand dollars a year for commercial fertilizers, but during the last twenty-five years this expenditure has steadily increased until it has reached a total amount for the whole period of twenty-eight million dollars, an average of over a million dollars a year, and now amounting to more than two million dollars annually.

In 1850, and for twenty years following, our corn yield was a little over 35 bushels per acre; during the eighties it fell to 34⅓ bushels, and during the nineties to 30 7-10 bushels, but it rose again to 35 3-10 bushels for the final ten-year period. Our corn yield for the entire State stands at the end of the century practically where it stood at the middle. In some portions it has materially fallen off, in other portions it has increased.The tendency, however, on our older lands is toward a steady and marked decrease in the yield of corn in Ohio, as will be shown further on.

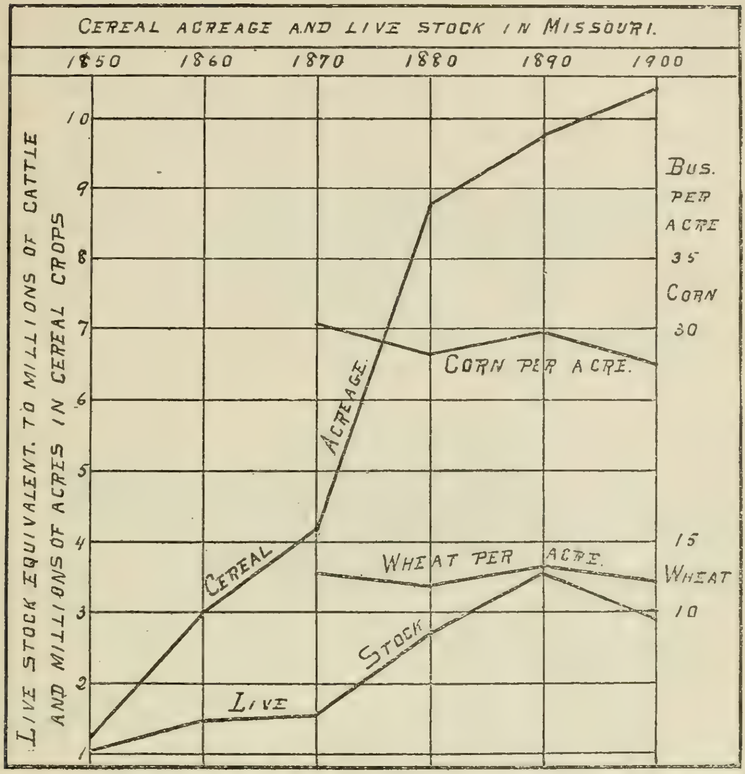
Our wheat yields began the period with an average of 13½ bushels, falling within the next twenty years to considerably below that point, rising again with the use of fertilizers to 14 bushels, and standing practically the same from that time forward—that is, for the twenty-five years past. Notwithstanding the expenditure for fertilizers, the bulk of which were used on the wheat crop, we have only maintained our wheat at the level at which it stood when these fertilizers came into use.

For your own State, I have compiled statistics as far back as I can get them. I have used for your crop yields the estimates of the United States Department of Agriculture, which are less accurate than those in Ohio, collected by the township assessors, and for crop areas and live stock numbers I have used the National Census statistics. It is not pretended that any of these statistics are absolutely correct, but they can be used for relative comparisons, for the comparison of one district with another and one period with another. The Missouri statistics are shown in chart II.*

---

*The live stock statistics for 1880, 1890 and 1900, shown on Charts I and II, have been compiled for animals on farms, excluding stock under one year old, following the estimates of the Twelfth Census, Vol. V, page CLXIII.

CHART II.



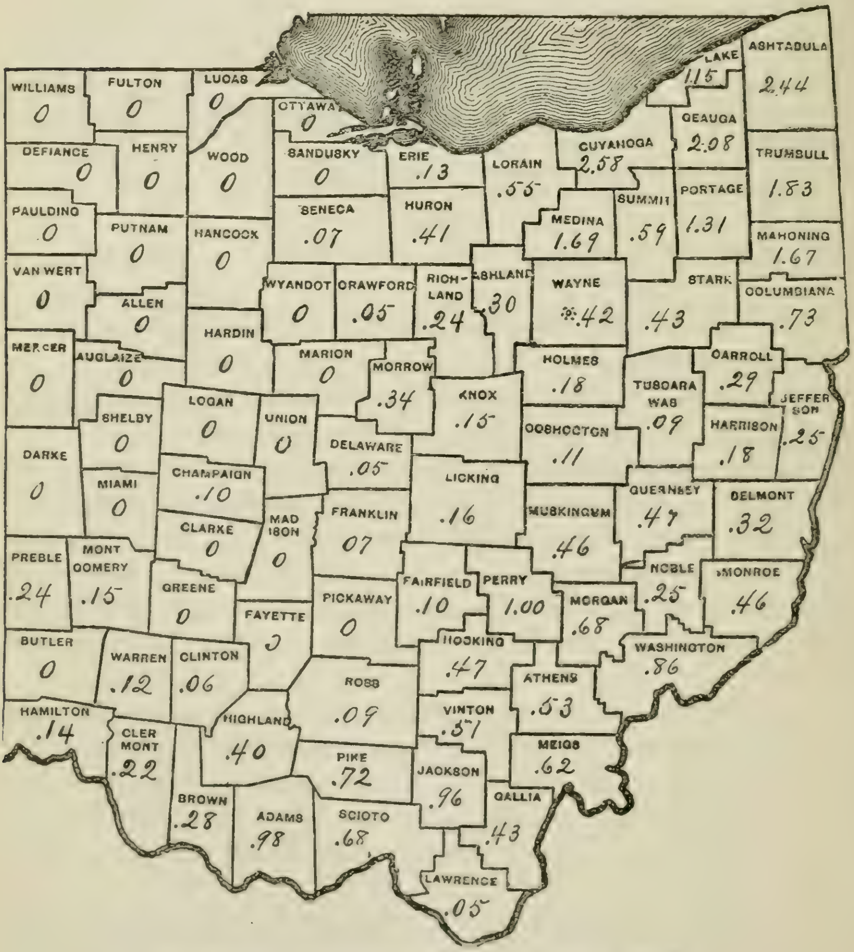
We find that the yield of corn has not been maintained for the period since the statistics began to be collected—that is, in 1865, the yield falling from 30 bushels at that time to twenty-seven bushels and a half during the last ten years. The yield of wheat has remained almost stationary. Beginning at nearly thirteen, it now stands at a little over twelve bushels per acre. Your live stock population increased steadily for the first thirty-five or forty years, but you have not maintained your numbers of live stock in proportion with your acreage in cereals, which has increased by leaps and bounds.

During the period following the war your country filled up rapidly. You are now cultivating something over ten million acres annually in the cereal crops, and you are keeping, according to the census statistics, the equivalent of less than three million head of cattle in the State, or less than one cattle beast to three acres in cereal crops.

So long as the Ohio farmer kept about the equivalent of about one cattle beast to two acres in cereal cultivation, the cereal yield was maintained with a slight increase. When the proportion of cattle decreased, then the yield fell off, and Missouri is giving us the same history over again that we have experienced in Ohio.

I said that about 1880 we began to use commercial fertilizers. On chart III I have shown the amount expended annually for fertilizers in the different sections of the State during the ten years, 1880-89. This expenditure is calculated per acre of wheat, because the fertilizers were used almost exclusively on the wheat crop. You will notice it is in Eastern, and to some extent in Southern Ohio, that these fertilizers have been used. In the northwestern part of the State, in what was once known as the Great Black Swamp, there was practically no expenditure for such fertilizers during this period.

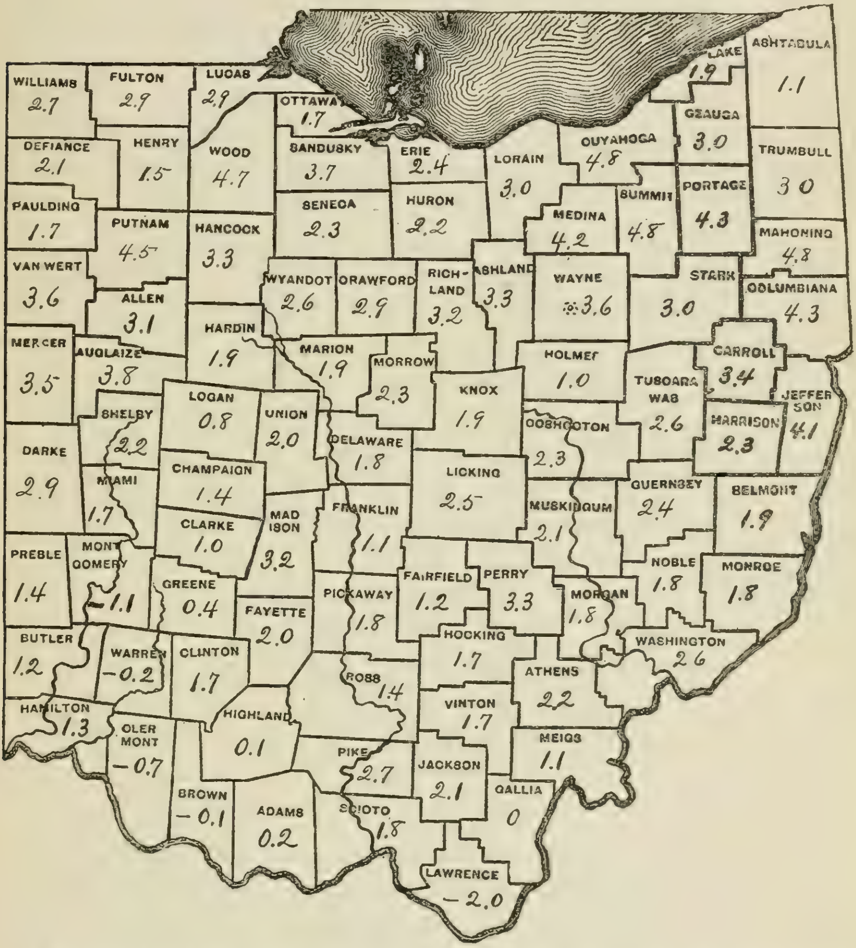
CHART III.


WILLIAMS 0
FULTON 0
LUCAS 0
OTTAWA 0
LAKE 1.15
ASHTABULA 2.44
DEFIANCE 0
HENRY 0
WOOD 0
SANDUSKY 0
ERIE .13
LORAIN .55
CUYAHOGA 2.58
GEAUGA 2.08
TRUMBULL 1.83
PAULDING 0
PUTNAM 0
HANCOCK 0
SENECA .07
HURON .41
MEDINA 1.69
SUMMIT .59
PORTAGE 1.31
MAHONING 1.67
VAN WERT 0
WYANDOT 0
CRAWFORD .05
RICHLAND .24
ASHLAND 30
WAYNE .42
STARK .43
COLUMBIANA .73
ALLEN 0
HARDIN 0
MERCER 0
AUGLAIZE 0
MARION 0
MORROW .34
HOLMES .18
CARROLL .29
TUSCARAWAS .09
JEFFERSON .25
LOGAN 0
UNION 0
KNOX .15
COSHOCTON .11
HARRISON .18
SHELBY 0
DELAWARE .05
DARKE 0
CHAMPAIGN .10
MIAMI 0
LICKING .16
GUERNSEY .47
BELMONT .32
MADISON 0
FRANKLIN 07
CLARKE 0
MUSKINGUM .46
PREBLE .24
MONTGOMERY .15
NOBLE .25
MONROE .46
GREENE 0
FAYETTE 0
PICKAWAY 0
FAIRFIELD .10
PERRY 1.00
MORGAN .68
BUTLER 0
WARREN .12
CLINTON .06
HOCKING .47
WASHINGTON .86
ATHENS .53
ROSS .09
VINTON .57
HAMILTON .14
CLERMONT .22
HIGHLAND .40
PIKE .72
JACKSON .96
MEIGS .62
GALLIA .43
BROWN .28
ADAMS .98
SCIOTO .68
LAWRENCE .05

Average cost of fertilizer per acre sown in wheat, 1880-89.

On chart IV is given the history of fifty years of wheat culture in Ohio. The figures here given show an increase in bushels per acre for the last twenty years as compared with the first twenty years of the half century period. You will notice the increase is

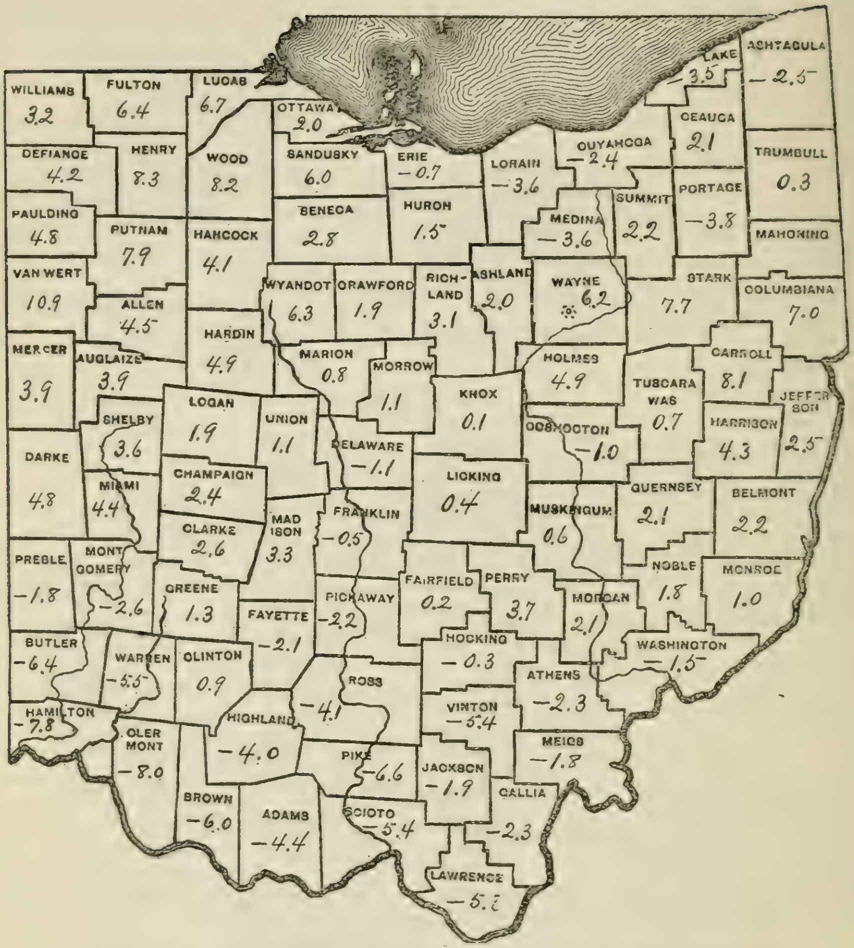
CHART IV.


WILLIAMS 2.7
FULTON 2.9
LUCAS 2.9
OTTAWA 1.7
LAKE 1.9
ASHTABULA 1.1
DEFIANCE 2.1
HENRY 1.5
WOOD 4.7
SANDUSKY 3.7
ERIE 2.4
LORAIN 3.0
CUYAHOGA 4.8
GEAUGA 3.0
TRUMBULL 3 0
PAULDING 1.7
PUTNAM 4.5
HANCOCK 3.3
SENECA 2.3
HURON 2.2
MEDINA 4.2
SUMMIT 4.8
PORTAGE 4.3
MAHONING 4.8
VAN WERT 3.6
ALLEN 3.1
WYANDOT 2.6
CRAWFORD 2.9
RICH-LAND 3.2
ASHLAND 3.3
WAYNE 3.6
STARK 3.0
COLUMBIANA 4.3
MERCER 3.5
AUGLAIZE 3.8
HARDIN 1.9
MARION 1.9
MORROW 2.3
KNOX 1.9
HOLMES 1.0
TUSCARA WAS 2.6
CARROLL 3.4
JEFFER SON 4.1
SHELBY 2.2
LOGAN 0.8
UNION 2.0
DELAWARE 1.8
COSHOCTON 2.3
HARRISON 2.3
DARKE 2.9
MIAMI 1.7
CHAMPAIGN 1.4
LICKING 2.5
MUSKINGUM 2.1
GUERNSEY 2.4
BELMONT 1.9
CLARKE 1.0
MAD ISON 3.2
FRANKLIN 1.1
PREBLE 1.4
MONT GOMERY 1.1
GREENE 0.4
PICKAWAY 1.8
FAIRFIELD 1.2
PERRY 3.3
MORGAN 1.8
NOBLE 1.8
MONROE 1.8
FAYETTE 2.0
HOCKING 1.7
WASHINGTON 2 6
BUTLER 1.2
WARREN -0.2
CLINTON 1.7
ROSS 1.4
ATHENS 2.2
HAMILTON 1.3
CLER MONT -0.7
HIGHLAND 0.1
VINTON 1.7
MEIGS 1.1
PIKE 2.7
JACKSON 2.1
GALLIA 0
BROWN -0.1
ADAMS 0.2
SCIOTO 1.8
LAWRENCE -2.0

Fifty years of wheat culture in Ohio: Increase or decrease of yield for the 20 years, 1880-99,, as compared with the 20 years, 1850-69.

practically as large over the western counties, where no fertilizer has been used, as where its use was most extensive. It is smaller in the middle than in the northern third of the State and is smaller in the southern portion than in the middle. Evidently, better drainage and better tillage have contributed nearly as much to increase of wheat yield as use of fertilizers.

CHART V.


WILLIAMS
3.2
FULTON
6.4
LUCAS
6.7
OTTAWA
2.0
LAKE
-3.5
ASHTABULA
-2.5
DEFIANCE
4.2
HENRY
8.3
WOOD
8.2
SANDUSKY
6.0
ERIE
-0.7
LORAIN
-3.6
CUYAHOGA
-2.4
GEAUGA
2.1
TRUMBULL
0.3
PAULDING
4.8
PUTNAM
7.9
HANCOCK
4.1
SENECA
2.8
HURON
1.5
MEDINA
-3.6
SUMMIT
2.2
PORTAGE
-3.8
MAHONING
VAN WERT
10.9
ALLEN
4.5
WYANDOT
6.3
CRAWFORD
1.9
RICH-LAND
3.1
ASHLAND
2.0
WAYNE
6.2
STARK
7.7
COLUMBIANA
7.0
MERCER
3.9
AUGLAIZE
3.9
HARDIN
4.9
MARION
0.8
MORROW
1.1
KNOX
0.1
HOLMES
4.9
TUSCARAWAS
0.7
CARROLL
8.1
JEFFERSON
2.5
SHELBY
3.6
LOGAN
1.9
UNION
1.1
DELAWARE
-1.1
COSHOCTON
-1.0
HARRISON
4.3
DARKE
4.8
MIAMI
4.4
CHAMPAIGN
2.4
LICKING
0.4
MUSKINGUM
0.6
GUERNSEY
2.1
BELMONT
2.2
CLARKE
2.6
MADISON
3.3
FRANKLIN
-0.5
PREBLE
-1.8
MONTGOMERY
-2.6
GREENE
1.3
FAYETTE
-2.1
PICKAWAY
-2.2
FAIRFIELD
0.2
PERRY
3.7
MORGAN
2.1
NOBLE
1.8
MONROE
1.0
BUTLER
-6.4
WARREN
-5.5
CLINTON
0.9
ROSS
-4.1
HOCKING
-0.3
ATHENS
-2.3
WASHINGTON
-1.5
HAMILTON
-7.8
CLERMONT
-8.0
HIGHLAND
-4.0
PIKE
-6.6
VINTON
-5.4
MEIGS
-1.8
JACKSON
-1.9
GALLIA
-2.3
BROWN
-6.0
ADAMS
-4.4
SCIOTO
-5.4
LAWRENCE
-5.2

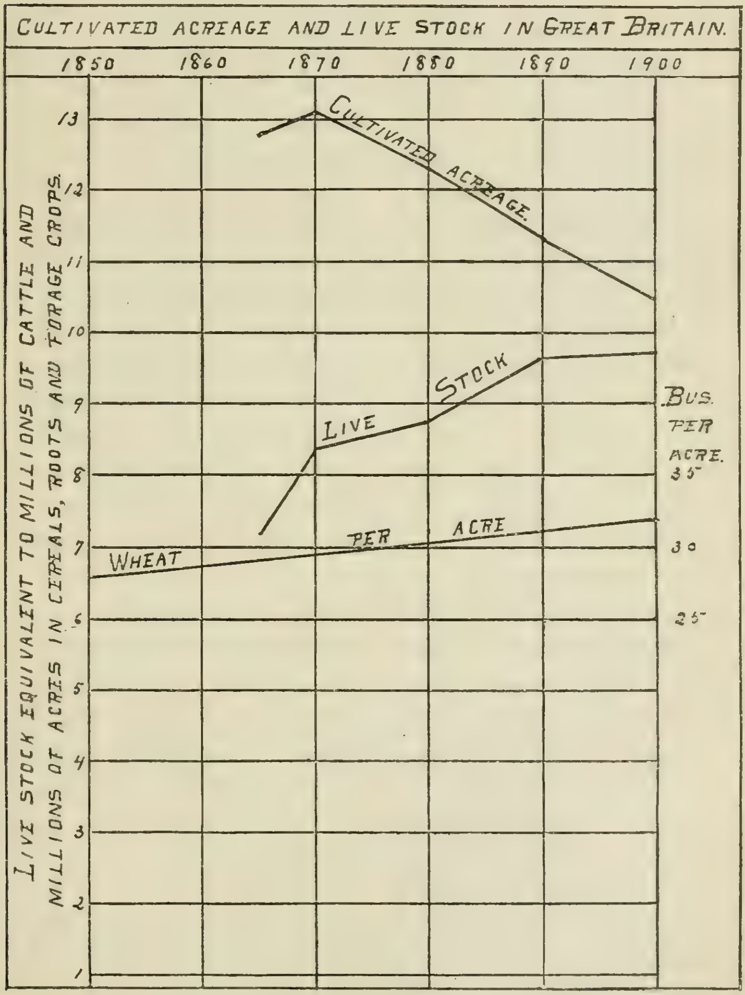
Corn in Ohio. Increase or decrease in yield per acre, 1850-59, to 1890-99.

Chart V is the history of the corn crop in Ohio, the crop which responds most readily to farm yard manure, and upon which fertilizers have been least used, and the figures show the increase or decrease in the yield per acre for the last as compared with the first 20-year period. You will notice that in the northwestern counties there has been a marked increase in the yield per acre. There has also been a large increase in some of the middle-eastern counties of the State. These counties represent the territory where sheep have been most largely kept. The great sheep region of the State lies there, while the great corn region of Ohio, formerly in the Miami and Scioto valleys, is now found in the flat northwestern counties, and Illinois farmers are selling their black, rich farms around

Bloomington and other places at $200 to $250 per acre, and buying these lands for one-half the money. The improvement in yield here has been brought about by drainage.

You will notice the minus sign before some of the figures in the northeastern and many of those in the southern part of the State. Those in the northeastern section are confined to the twelve counties comprising what is known as the Western Reserve, a territory originally settled by immigrants from Connecticut, who brought with them the custom of measuring corn by the bushel of ears and not by the shelled bushel. Of late years the yields have been more generally reported as shelled bushels, and it is probable that the ap-

CHART VI.



parent falling off in yield is due largely to the fact that they are now counting their yield by the bushel of grain instead of by the bushel of ears.

But where the increase has fallen off most largely is in the rich valleys of the Scioto, the Muskingum and the Miamis— regions where farmers have grown corn year after year on the same lands for fifty to seventy-five years, or longer, and where they say their yields are as large as ever. The statistics show, however, that they are mistaken. All this means that these farmers are neglecting the keeping of live stock and the careful handling of manure, but are attempting to replace that natural source of fertility with commercial fertilizers, and the soil is losing its fertility. When I talk on this subject in Ohio our farmers answer by saying that they can not keep stock enough to furnish the manure necessary to maintain the fertility of their lands. But their fathers did keep enough.

I have shown on chart VI the history of cereal production and the live stock industry in Great Britain. The British people did not begin keeping statistics of crop production until about 1865, but there are statistics of the yield of wheat per acre which go back beyond that period. Sir John B. Lawes, the founder of the Rothamsted Experiment Station, estimated that in 1850, when he was beginning his work, the annual yield of wheat in Great Britain was 28½ bushels per acre—a yield to which it had been brought by the use of animal manure. Sir John B. Lawes was himself the first person to engage extensively in the manufacture of artificial fertilizers. His investigations led to the establishment of the great Rothamsted Experiment Station in 1843.

The cultivated area in Great Britain at that time was nearly thirteen million acres. It rose in 1870 to a little above that point. From that period up to the present time it has steadily fallen, until there is now in cultivation only ten million acres. The British farmers raise no corn, but grow wheat, oats, barley and forage crops. They had in 1865 a live stock population equivalent to a little more than seven million cattle. They have steadily increased that population until they have now the equivalent of nearly ten million cattle in that country.

You have a larger amount of waste land in Missouri than we have in Ohio, so the actual population does not vary much between the two States.

Great Britain, the center of the world's agricultural industry, where land is higher in price than any other agricultural land in the world, is keeping today fifty per cent more cattle and from two to three times as many sheep, although practically only about one-third as many swine, but as between the three a very much greater live stock population than either of these States, where land is far less valuable. The British farmer does not do this for fun. He does it because it pays him better than raising cereals. And while he is doing it his yield of wheat is increasing. The average yield for the entire country of England, Scotland and Wales is estimated now at more than 31 bushels per acre, and the yield for the harvest just closed is reported at 33⅓ bushels for the entire country.

THE VALUE OF FARM YARD MANURE.

What is the value of farm yard manure? That question has already been discussed here today, but I wish to take it up briefly from another standpoint and to give you some of the results of our work on this problem at the Ohio station. We have for several years been feeding steers, with an especial effort to learn the amount of manure which might be expected to be produced by the animal, as well as its worth. We have attempted to determine the value of the manure, on the one hand by chemical analysis, on the other by actual test in the field. These tests are now going on side by side. Some of the results of this work are shown in table I:

TABLE I.—FEEDING TESTS: FEED CONSUMED, GAIN IN WEIGHT AND MANURE PRODUCED.

Test.	Animals in test.	Days fed.	Average live weight.		Feed consumed per day per 1,000 lbs. live weight.			
			Initial.	Final.	Concentrates.	Roughage.	Silage.	Total dry substan'e
No.	No.	No.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
I..........	48 steers........	390	448	1,150	11.9	6.5	6.7	17.6
II..........	30 "	182	868	1,260	11.9	7.0	9.4	18.8
III..........	28 "	182	874	1,230	12.7	6.8	11.8	17.7
IV..........	63 "	49	1,089	1,234	15.45	8.06	....	20.0

Test.	Average gain in live weight.		Dry substance consumed for 1 lb. gain in live weight.	Manure produced.	Per day per 1,000 lbs. live weight.	
	Per head.	Per day.		Total.	Including straw.	Excluding straw.
No.	Lbs.	Lbs.	Lbs.	Tons.	Lbs.	Lbs.
I..................	729	1.87	9.41	350	39.3	33.2
II..................	360	1.98	9.49	118	41.4	34.6
III..................	356	1.96	9.03	128	42.6	36.1
IV..................	145	2.95	6.78	89	49.9	42.4

In one feeding test we fed a lot of 48 Angus calves, born in the Panhandle of Texas and sent through to our Ohio farm. We fed them 390 days. Their initial weight was 448 pounds and their final weight 1,150 pounds. They consumed during the period 11.9 pounds of grain per day per 1,000 pounds of live weight, and 6½ pounds of hay, with 6.7 pounds of silage, the whole ration containing 17.6 pounds of dry substance.

Two other lots of western cattle, one containing 30 and the other 28 head, were fed 182 days, and a fourth lot of 63 heavy cattle were fed for 49 days.

In the second part of this table is shown the average gain per head in live weight for each of these lots, both for the total period of the test and per day; the dry substance consumed for each pound of gain in live weight, and the amount of manure produced, both over the total period for each animal, and per thousand pounds live weight per day, calculated both with and without the straw used as bedding.

The chief purpose for which I have prepared this table is to bring out the actual amount of manure produced. It shows that there was a daily production of 39 pounds of manure per 1,000 pounds of live weight by the young cattle, that is, the calves and young stock, to nearly 50 pounds of manure per 1,000 pounds of live weight for the older cattle. In other words, the older cattle have produced more manure, not only actually but relatively, than the young.

In table II is shown the quantity of nitrogen, phosphorus and potassium contained in the feed and bedding consumed in these tests, as calculated from average analyses; the cost of the feed and bedding; the quantities of these elements recovered in the manure, as determined by analyses of the manure by Mr. J. W. Ames, chemist to the Ohio Station, and the value of these constituents at the rate at which they are valued in tankage and muriate of potash by the Secretary of the State Board of Agriculture, who is charged with inspection of fertilizers in our State.

TABLE II.—Fertilizing elements contained in feed and bedding and recovered in manure, cost of feed and bedding, and chemical value of manure.

Fertilizing elements.	Contained in feed and bedding. Pounds.	Recovered in manure.			Cost of feed and bedding.
		Pounds.	Per cent.	Value.	
Nitrogen	15,577	5,795	37	$1,122	$5,610
Phosphorus	3,095	1,862	60		
Potassium	7,229	5,137	71		

These analyses indicate that nearly 40 per cent of the total nitrogen given in feed and bedding has been recovered in the manure; 60 per cent of the total phosphorus, and more than 70 per cent of the total potassium. If we give to the elements thus recovered the values given by the State inspector of fertilizers in Ohio to the same elements, when carried in tankage and muriate of potash, they would have a total value amounting to about 20 per cent of the cost of the feed and bedding given to the cattle.

I would call attention to the fact that the quantity of manure produced, as indicated by our figures, is smaller than has been reported from some other sources. The cattle producing this manure were in part kept on a dirt floor and in part upon a cemented floor, and the manure was collected and weighed about once each month, so that there was some loss before it was weighed. The figures, therefore, are below the possible attainment in manure production.

Not only have we subjected the manure to chemical analysis, but for ten years past we have been conducting field experiments, in order to determine whether the results indicated by chemical analysis could be realized in actual farm practice. These experiments I described here a year ago. Briefly stated, when manure has been reenforced with materials carrying phosphorus, thus bringing out the full effect of its relative excess in nitrogen and potassium, we have been able to secure as great an increase of crop from the pound of nitrogen, phosphorus and potassium carried in manure as from the same weight of the same elements carried in the most effective combination of chemical fertilizers as yet discovered in our experiments, thus fully realizing the theoretical value of manure, when properly balanced, as indicated by chemical analysis.

To put this matter in another way, we have realized from each ton of phosphated manure, applied to corn which has been followed by wheat and clover without further manuring or fertilizing, a 7-year average increase of nearly 4 bushels of corn, more than two bushels of wheat and more than 300 pounds of hay.

The average Ohio farm contains 88½ acres. Half of this area is occupied with cereal crops, about one-third of the cereal acreage being given to corn. There is a live stock population on this average farm, including horses, equivalent to thirteen head of cattle beasts. The average farmer buys fertilizer to the cost of about $8.00 annually. If he kept live stock today on the basis on which his father kept it, up to the seventies, instead of thirteen head he would have twenty-two head. Instead of having only three and a half tons of manure for each acre in corn, he would have five and a half tons; that is, he would have manure enough to bring him in eight bushels to the acre of corn more than he is now getting, four more of wheat, and nearly 700 pounds more of hay. In other words, his present yield of corn, which is thirty-five bushels per acre, would be raised to forty-three; his wheat yield would be increased from 14 to 18 bushels, and his hay yield would be brought up to nearly a ton and a half per acre. The annual value of the produce of each of the 275,000 farms in Ohio would be increased by $100.00, an increase amounting to twenty-seven million dollars for the State as a whole.

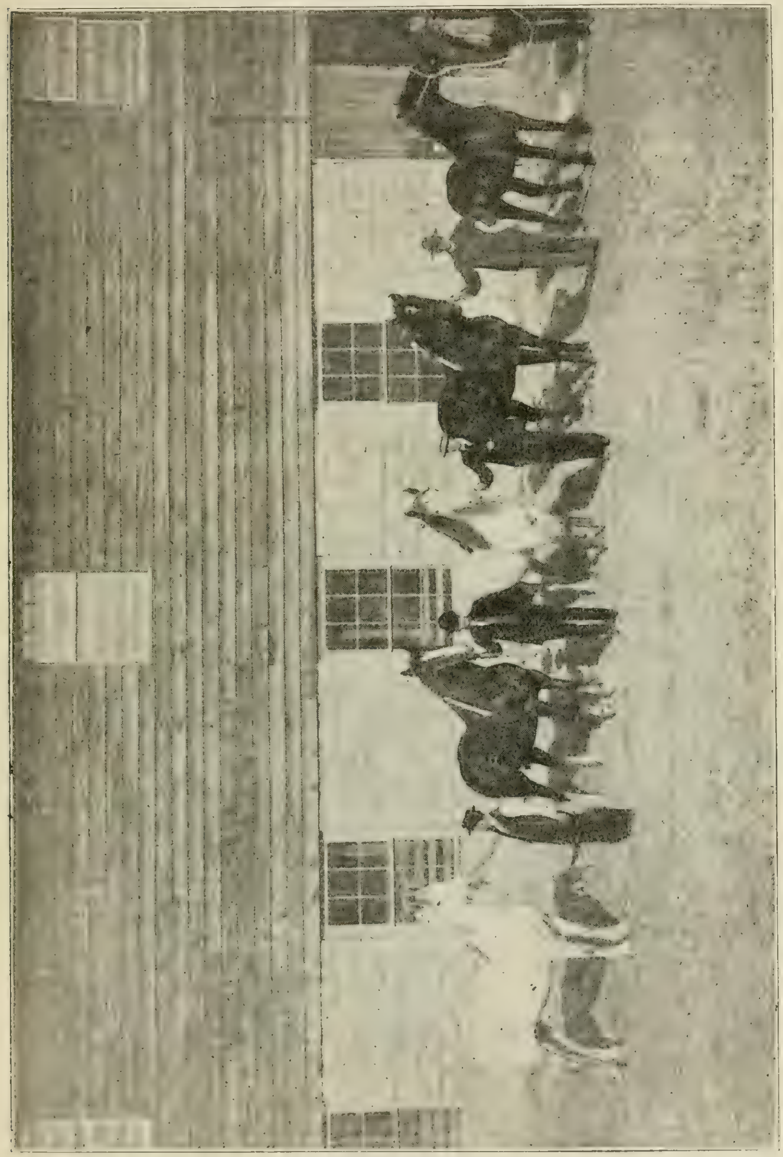
I estimate that our farmers are now paying out something like two million dollars a year in the purchase of commercial fertilizers. And while they are paying out this enormous sum for these fertilizers, they are washing into the Ohio river, and thence to the cotton fields of the South, to the extent of ten or fifteen million dollars annually, the valuable waste product from their barnyards, and are thus losing a possible increase in the production of their farms to the value of fifteen or twenty million dollars more. This gigantic waste is wholly unnecessary and inexcusable. Its prevention would require only the intelligent exercise of a little more care and skill.

I do not forget the fact that farm labor is becoming more and more an unsolved problem all over our country perhaps more so with us than with you; but as Professor Smith has shown us, I doubt whether in the long run the keeping of live stock is not a saving of labor instead of an operation involving greater labor. You can harvest your crops with less money if they go through your feed lots than if they go through the elevators, and live stock husbandry means the distribution of labor over the entire year, as against its concentration during the summer months. It seems to me, farmers— and I am one of you, and know what it is to feed live stock on the small farm—it seems to me that in this question of the intelligent handling of live stock and the careful saving of manure lies the only road to successful agriculture in all this broad land of ours.

WHAT CLASS OF HORSES SHALL WE BREED?

(E. A. Trowbridge, Assistant in Animal Husbandry, Missouri Agriculture College.)

The range of prices for good horses and mules during the past few years is gradually bringing a realization of the vast importance of this industry to not only the people of Missouri but to all the world. During the past thirty years the horse has met and successfully competed with the electric car, the bicycle and the automobile. In the early part of the nineteenth century the railroad began to perform a considerable part of the labor, which up to that time had furnished a reason for the existence of a certain class of horses. But this class of horses, whose labor was from that time on to be performed by steam power, soon adjusted themselves to the new en-



Four registered Percheron mares and colt, owned by Missouri Agricultural College.

vironment, and today we no longer think of the horse and the railroad train as competitors.

The number of horses produced in America at present is greater than ever before, and the prices average higher than in any time past. This is due to two permanent and potent factors. First, that as colonization and civilization advance, the horse becomes more indispensable to the people of our country; second, the people of other parts of the world are realizing the value of America as a breeding ground for good horses and mules. Consequently, the yearly export of these classes of animals is a heavy drain on the stock in the country. Supply and demand are the factors which regulate prices in all kinds of business, hence the great demand of our own and foreign countries upon the limited supply has brought about the present high prices.

There is another reason which, though of somewhat different nature, was very important in its temporary effect, namely, the shamefully low prices paid for horses during what is now come to be termed "The horse market depression" of 1895-6-7. This resulted principally from two causes. First, and of little importance, the passing out of use of the horse-street-car. Second, and vastly important, the financial panic of 1893 and the subsequent years. The bicycle had only a very slight effect upon the price of horses. The first brought about only a temporary derangement of the market classes and the prices. Its effect was felt when the great number of light horses previously used for car service were thrown upon the market to be taken up by a new class of buyers. They had to be sold at a sacrifice, because the market which they were intended to supply had ceased to exist. Hence, this fact started the downward course of the prices on the horse market. The second of these reasons, namely, the business panic, was first felt when buyers refused to take horses at any other than sacrifice prices, and more severely when scarcity of money began to stop business to some extent, and thus decrease the demand for horses.

When men who had horses for sale became aware of the lowering price of their stock they did, in most cases, the thing which only tended to aggravate the already congested condition, by placing their horses on an over-supplied market. The result of their action could be nothing other than to add impetus to the already descending market, consequently the extremely low prices and slight demand for horses during 1895-6-7.

The prices were at their lowest when the salable horses throughout the country had been hurriedly thrown upon the market and had left the farmers and horse breeders with only a comparatively small number of horses on hand. This condition was exaggerated greatly by the demoralized condition of the finances of the nation.

Then came the reaction. As the panic began to clear away business sprang up, and the horse market became active in proportion. But the demand increased at a much greater rate than did the supply, and prices rose rapidly. The exportation of American bred horses began shortly after the Columbian Exposition of 1893, and served to strengthen the market greatly. The great mass of horse breeders of the country, who had only a short time before sold at a sacrifice their likely young brood mares, as well as the older ones, now found themselves looking about for animals with which to again start into the business. To regain the breeding stock necessarily took three or four years, and to get horses to a marketable age and condition took three or four more years. During that period of time the demand has been constantly growing because of the advancement and improvement in all parts of the country which can not be carried on successfully without vast numbers of horses and mules, and we find the prices for these animals higher than ever before.

Rex McDonald, perhaps the greatest living saddle horse. Bred by Joseph McDonald, Mexico, Mo. Now owned and kept in Columbia.

From the experiences of the past and the outlook for the future there should be for the man of good judgment a profit far above that of the average business, accruing from the horse industry. But the question naturally presents itself, "Where are the horses to be raised, and where used?" The United States Census Report of 1900 states that 86.2 per cent of all the horses in the United States are owned on the farms, and that 13.8 per cent are owned in cities and other places. The same report gives the number of mules owned on the farm as 95 per cent, the remaining 5 per cent owned in cities and various other places. From these figures, and from what we all know to be the congested condition of affairs in cities and towns, we are forced to turn to the farm for the production of horses in America.

If we were to divide the people interested in horse business they would fall into three classes. First, those who rear no horses but use them to a greater or less degree. This class includes grain farmers, lumbermen, miners, city haulers, liverymen and people living in cities who drive for business or for pleasure. Second, those who make the breeding and rearing of horses the first object of their business. This class includes the breeders of pure bred horses almost entirely, and their product nearly all goes to supply the breeders' market. Third, the class of men who breed and rear a few horses in excess of their own demand.

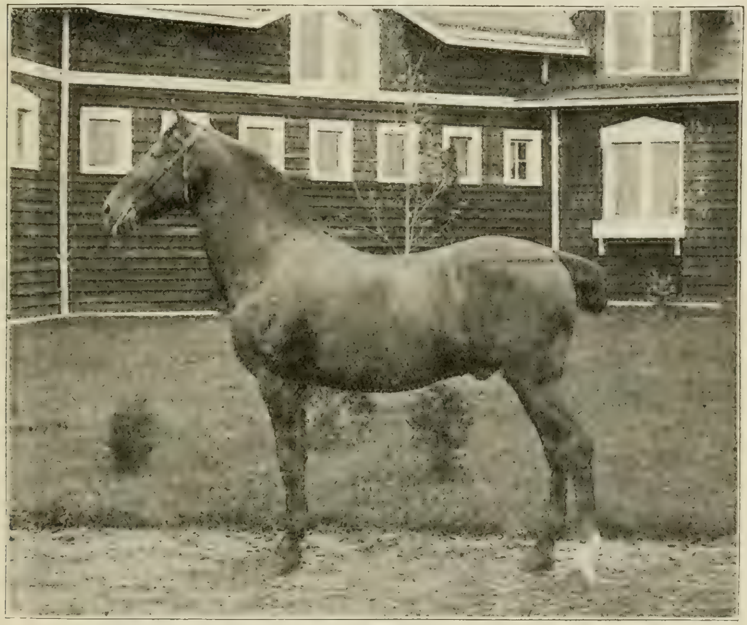
From this it is evident, since the first class mentioned rear practically no horses and those bred and reared by the second class of men furnish the supply for the breeders' market only, that the great mass of horses produced in this country must come from the average or general farmer.

With the average or general farmer to produce the horses for our country the question arises "What kind of horses shall he breed?" He must have a two-fold object in view, that of supplying his own demand as well as the demand of the market. These reasons will vary in importance according to the extent that he has taken up the business. In supplying his own demand he will choose the class of horses which he naturally prefers and which best suit his environments, but to meet the market demand he must breed horses which will come within the bounds of the regularly defined market classes.

Although there are many classes recognized on the market, there are a few which are of far more importance than the rest. The horses which fill the less important classes are the results of attempts to produce horses of better kind, or else they are an outgrowth of the mating of animals with no object in view other than that of raising a foal, whether it be good or bad. The greater number of the *high priced* horses which come on the market fall into the following classes: drafters, coachers, or carriage horses, light drivers, saddlers.

There are besides these many other classes, such as expressers, bussers, army horses, farm chunks, roadsters, etc., all of which may be horses of good quality, but do not fit the above named classes.

The market recognizes a horse as a drafter when he stands 15.3 hands high or over, and weighs 1600 pounds or above. Horses standing much over 17 hands are not as popular as the shorter legged ones, but it has been estimated that every pound of weight over 1600 pounds was worth 25 cents per pound. Drafters must have a vigorous action, with a free rapid and straight walk, and a true and well balanced trot. The head must show quality and be set on a well muscled neck which inclines to arch. The shoulders and pasterns must be set rather obliquely in order to give the required action and to eliminate as much as possible the effect of concussion on hards streets and roads. A short, strong back and coupling, with a deep chest and barrel, are very essential. The croup should not be drooping, but be well muscled, as should the hind quarters throughout. The feet should be large and free from any



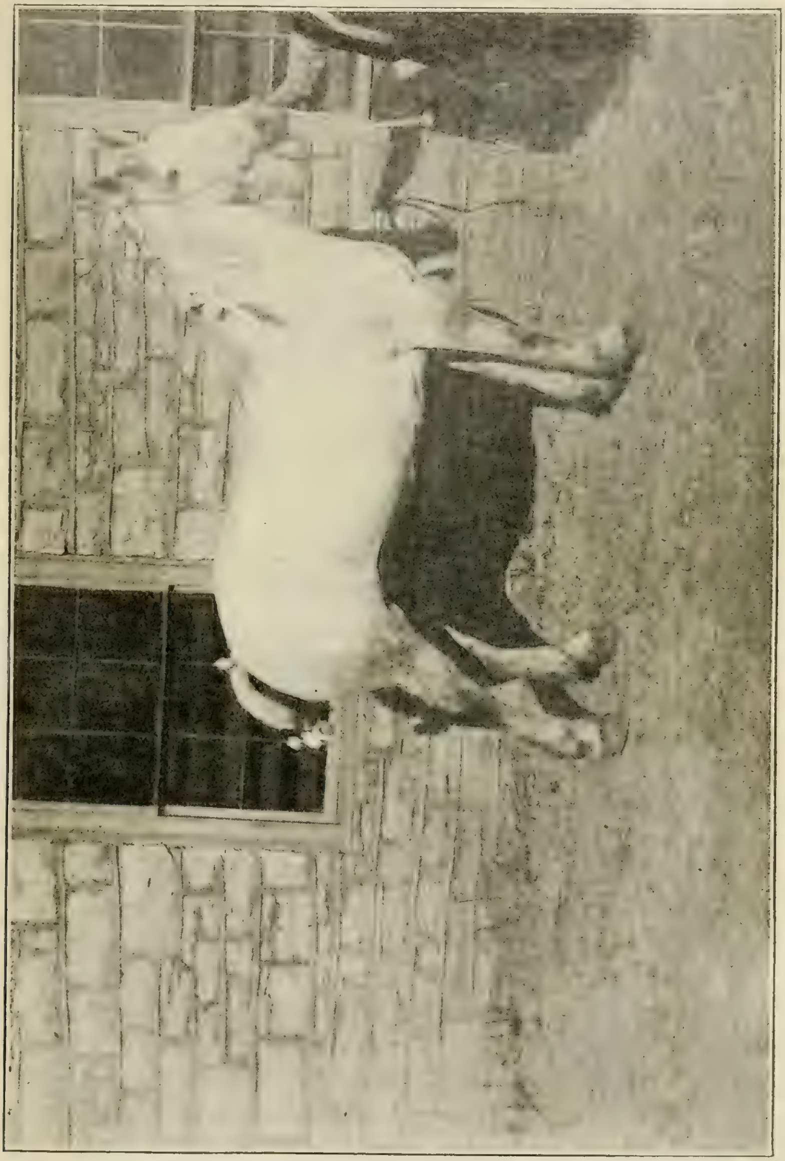
Drummer Boy—A splendid type of heavy harness horse.

unsoundness, and the bone of good size and quality throughout—in short, a "blocky" horse with quality, and carrying in every part of his conformation an appearance of strength and activity. Horses which fill the draft horse requirement as to size, but not as to quality, are sold as "loggers," while "feeders" are, as the word indicates, drafters in poor flesh. "Farm chunks" are horses which are not big enough to belong to the draft class, yet have the characteristic conformation and action.

The coach, or heavy carriage horse stands 15.2 to 16 hands high, and weighs 1100 to 1300 pounds. The three essentials of a coacher are style, action and finish, which are never found in animals other than those with considerable quality. The head must be neat, with a clean-cut arched neck, short and broad back, and long, level croup, with a tail carried high. Heavy harness horses are always "docked." The barrel should have good depth, and the entire body should be well filled in its outline and entirely free from any angular appearance. The shoulders and pasterns must be decidedly oblique, and strong legs and joints with good feet are very important. When moving the knees and hocks should fold well up, giving a high "trappy" action rather than a long stride. Besides the "finish" and high action, style and gracefulness should be evident in every movement.

Light drivers should stand 15.1 to 16 hands high, and weigh 950 to 1,150 pounds. They differ from the coach horse in being horses of less size with more endurance. They are more angular in conformation, and have a long rather than high stride when in action, but show quality throughout. Drivers must have good heads, with rather thin necks set on very long and moderately sloping shoulders. Deep, rather than wide chests, are required. The back is of medium length, the croups are often somewhat drooping, and the flanks tend to be light. Legs and feet in this class are of great importance, because of the amount of concussion to which they are subjected. There is an appearance of the greatest economy of material with the greatest efficiency of the animal, which is quite characteristic of light drivers.

The American saddle horse is very closely related to the thoroughbred, and they possess many like characteristics. The extreme quality, endurance and beauty is common to both. Saddlers stand 15.1 to 16 hands and weigh 1,000 to 1,200 pounds. They must have heads and necks showing extreme quality and gracefulness, with very long oblique shoulders, and must be well muscled over the back and loin. The tail is set high on a long but "neatly turned" rump and carried gracefully. The chest is deep rather than wide, and the flank is moderately full. They are required to have the following five gaits: walk, trot, canter, rack, and either running walk, fox trot or slow pace. To withstand the concussion which is necessitated by these gaits, the saddler's feet and legs must be above reproach. The hock joints should be particularly strong and the pasterns markedly sloping.



A good type of Peacheron mare, owned by Missouri Agricultural College.

Besides the five-gaited horse, we have the "walk, trot and canter horse," which is somewhat heavier and shows less quality. The other classes which are recognized on the market are horses which fall between these classes, or are blemished or unsound, and for that reason are rejected.

Although Missouri is one of the foremost States in the production of horses, there are still evidences of carelessness in the horse breeding operations. A more thorough study of the principles of breeding and a more definite object in view when animals are mated would result in vast improvement in the horse stock of the State. That it is impossible to obtain good offspring from inferior or unsound breeding stock is a fact which every horse breeder ought to know, and to which he should pay close attention. Breeders should also realize that it is contrary to the laws of nature to produce superior animals from violent outcrosses or the crossing of animals of different breeds. To produce stock of the best class one should first decide what class of horses will be best suited to his own individual needs, and which will, when marketed, fit one of the better classes. He should then be persistent and determined in his efforts to breed horses which fulfill his ideal.

In producing the draft horse, good sound mares with as much of the blood of some one draft breed as possible should be chosen and mated with stallions of the same breed. The offspring from this mating should be mated with another stallion of the same kind, and after three or four successive crosses the stock of horses produced can not be other than high class horses, if they have been properly cared for and good judgment has been used in handling them.

The same principle applies to all classes of horses. In breeding coach horses select mares of that type with as much of the blood of some of the coach breeds as possible, and after three or four top crosses have been made the results will be very evident. In the production of light harness horses or saddlers the same principle holds true and should be followed closely.

The reputation of Missouri as a horse breeding State has been gained by the light horses it has produced. The native stock in many parts of the State is well graded up with American trotting horses, saddlers and thoroughbreds. In those parts of the State the people have found these horses better adapted to their conditions, and should take advantage of the good mares which possess four or five top crosses of trotting horse or saddle horse blood and mate them with the best available stallions of their respective breeds. Then, with good care and handling, the percentage of good horses will be greatly increased. In short, a study of the laws of breeding and an inauguration of a good systematic effort will make Missouri even more important than it is now in the production of both draft and light horses of the highest type and excellence.

The President (Hon. T. J. Wornall)—Gentlemen of the Convention: As another token of Missouri's greatness and of her recognized greatness among the states of the Union, we have on our program tonight a brainy Kansan, who has chosen this for his home— a man that needs no introduction, I am proud to say, to the people of Missouri, nor do I think to the people of this country at all, for he has tracked to his lair and brought to bay that artful dodger, John D. Rockefeller himself. And it gives me great pleasure to introduce to you, if you can take it as an introduction, knowing him as you do, General Hadley, Attorney-General of Missouri, who will talk on "Combinations." (Applause—continued applause.)

COMBINATIONS.

(Hon. Herbert S. Hadley, Attorney-General of Missouri.)

Mr. Chairman, Ladies and Gentlemen: It is not often that I have occasion to entertain a difference of opinion with my good friend, Senator Wornall. He is a very agreeable gentleman, although I have sometimes thought he was a little bit off on the tariff question. (Applause.) But when I realize the fact that I enjoy tonight the distinction of being a Missourian, as a matter of choice and not as a matter of accident, I have to express just a slight difference of opinion as to the correctness of the Senator's introduction. I concede to the Missourian who is born in this great State the sense of satisfaction he may feel in being a native citizen of Missouri; but when I contemplate that I am a Missourian by choice, and that I came to Missouri with my clothes on, I yield to no man in my gratification at being a citizen of this imperial commonwealth.

I do not know exactly the purpose of my presence here tonight. Something like a month ago I received an invitation from the President of the Missouri State University to come here upon this occasion and just talk with my hands in my pockets, and that I am prepared to do. I have no difficulty in performing the latter part of that request, at any rate, as you will observe. That is a peculiar performance that is incident to our sex, and we can do it without difficulty. (Applause.)

Consequently, I looked forward to the idea of making a speech to the students of Missouri State University upon what is known as the "Memorial Day" in the history of this great institution. Afterwards I was notified that, like a railroad time table, subject to change without notice, I had been switched to the Farmers' convention. For variety and vicissitudes in a speaking engagement that is about as radical a change as I have ever experienced. I find myself in a position something like a two-ring circus. I am speaking both to students and to farmers, or perhaps, if I should take my friend, Senator Wornall, as a type of the latter class, I should say "agriculturists."

I will say, however, that I was at a loss when I found I was here in a dual capacity to know exactly what I should say or what I should talk about. It is always an easy thing to promise to make a speech if the date of performance is only sufficiently far remote in the future. It is something like signing a note due in ten years. Signing is comparatively easy, but when it comes to the matter of performance, the difficulties are somewhat greater.

In view of the presence here of you gentlemen from the country, I may liken my position in this regard to that of the man from a metropolitan community who visited relatives in the country, and when asked to lead a yearling calf down to the pasture he very cheerfully attempted to comply. In performing the duty he came to a fence in which there was a gate, and being inexperienced in handling live stock, he proceeded to tie one end—the loose end—of the rope around his leg, while he proceeded to open the gate. When his solicitous friends and relatives disentangled him from a pile of brush down the road, they said to him, "What in the world did you do that for?" He replied, "Well, I had not gone more than ten feet when I discovered my mistake."

I wish, however, to say something that I hope will be to the advantage of you both. I want to say something that is applicable to both students and farmers. You are necessary, the one to the other. In a certain way and in a certain sense you are the complement, the one or the other. The practice of those things which tend to upbuild intellectual and moral development is as necessary as is the cultivation of the farm and of the field. As the material prosperity of a state or country is incident to its intellectual prosperity, so when the two are combined moral prosperity is the usual accompaniment. The highest results in educational work are made possible only by a condition of prosperity. Consequently the farmer should feel and take an active interest in the development of the educational institutions of the State, and the educational institutions should feel the necessity of the prosperity of the farm and field.

But all this is preliminary. Every Missourian should feel proud of Missouri State University. Every Missourian should be loyal to Missouri State University. It was not my good fortune, or, rather, it was my misfortune not to be a student or graduate of this University. It is sometimes said that one's loss is another's gain. I don't know whether that principle would apply in this case, and that my misfortune in not being a student here would be a gain to this institution.

But I do not purpose that this misfortune shall go further than the first generation, for I purpose that my two sons, both born on Missouri soil, shall be students of the Missouri University. And I think the most appropriate and expressive manner in which any Missouri citizen can express his interest in her chief educational institution is to see that that institution is appropriately and fittingly endowed. Now, I do not mean in any way to speak in criticism of what has occurred in the past, and what I shall say shall be free of even a suggestion of political significance. But there has been in this State too much of a disposition to laud economy for the mere sake of economy—it is not so much a disposition to laud economy as it is the mere fact of not spending money. We see its expression not only in our educational system, but also in other departments of this great State of ours. Does any citizen of this State who feels any pride in its prosperity have a feeling of satisfaction in the thought that we have a State capitol which is inferior to the state capitol of every contiguous state, and inferior to the capitols of most of the states of the American Union? Should you feel any satisfaction in the thought that we have saved money by having for our department of justice a building which for years has been unsanitary, insufficient and unsafe. Should you feel any satisfaction in the fact that in saving money the officials of the State of Missouri have for years received salaries one-third to one-half less than the salaries of officials of states similarly situated in the matter of resources, wealth and population.

Now, I do not stand here to speak in criticism of the actions of past legislatures. I do not stand here in any sense as a critic of the present legislature. This University and the other educational institutions of this State have been well conducted and have accomplished as much for the cause of education as any institutions in the country with no greter means afforded them. But you can readily see how much more they could and how much more they should have accomplished had they been dealt with more freely and liberally in the matter of endowment, in the matter of buildings, in the matter of equipment and in the matter of salaries for their professors and instructors. I say to you tonight that the State University of the fifth State in the Union in population and wealth should be second to none in its endowment, in its equipment, in its buildings and equipment for carrying on of educational work, and in the salaries of the men who instruct the young manhood and the young womanhood of this splendid State of ours.

Now, I am not saying that as a criticism in any way of things done in the past, nor am I speaking as a representative of this institution. But standing here tonight before this audience, and in this institution, I feel that I should not fail to point out those things which I see are needed for the education of the youth of our State, and that I should say this much at least as to what should be the intimate relations and active interests existing between the people of the State and their great University. And there can be no doubt but that in the creation of the most harmonious feeling there will be the best results for the University and for the State. Because a university should express, so far as it can express, in character and ideals of the people of the State of which it is a part. And particularly is this true in this commonwealth of ours, for when the State University represents the true Missouri idea, then will it represent, in the best way it can represent it, the true University idea and the true University spirit; because the predominnt idea, I might say the paramount significance that belongs to Missouri, is that the Missourian has been the great pioneer. He, perhaps more than the representative of any other state or any other section of country, has had an influence upon the development of our national life and institutions. With the sole exception of the New England Puritan, he had had a more marked influence in this regard than the representative of any other section of the country. To the New England Puritan belongs the distinction of having given to the American people the institutions of civil, religious and political liberty which he brought to the new continent. And he has left the impress of his personal characteristics in that country which lies between the Mississippi and the Atlantic. But the Missourian has made his influence felt in the development of the institutions, in the making of the laws, and in the directing of the growth of civilization, and in moulding the institutions of society in that vast empire that lies between the Mississippi and the Pacific. The Missourian has been the pioneer of the west. From the time of Alexander W. Doniphan, the one man Abraham Lincoln said he had ever met who came up to his expectations, at the head of his band of Missourians made his wonderful march into the southwest, the Missourian has always been upon that firing line which is the protest of civilization against the wilderness. In that ceaseless yearning for the frontier which has drawn the star of empire in its course across the continent, the Missourian has usually been at the head of the procession.

But so completely has he shaped the development of the states west of the Mississippi river that he has in recent years been paying some attention to the development of the resources of his own State, and to the correction of evils within our own borders. And while the Missourian has accomplished much in this regard, while he has done much in bringing about a changed and better condition of public affairs, he has come to the realization of the fact that any permanent work in wiping out the evils in the public system must be founded upon the reform of those commercial and industrial conditions which tend to dishonor and degrade. In this wave of reform that has swept across the country in recent years, causing a wonderful increase of interest in the performance of the duties of citizenship, demanding a higher standard of aggressive honesty upon the part of public officials, demanding that every citizen should recognize his responsibility in the performance of his duties to the State, the Missourian has also been something of a pioneer.

But when he has come to investigate each of these evils and abuses, he has found in the last analysis, as the original cause or source of this evil, that there has been some business or industrial enterprise unlawful in its plan of organization or illegal in the way in which its affairs have been conducted.

If it was the State legislature or if it was the city council that had been bribed to defeat or enact legislation, it was found, when the conditions were investigated which had resulted in these abuses, that there had been some commercial or industrial enterprise, unlawful in its plan of organization or illegal in its business methods, that had been seeking some unfair or illegal privilege from the representatives of the people.

If it was some man high in public or official life who had, under the pretense of being a lawyer, received a princely retainer from some large interest for the practice of his influence instead of the practice of his profession, it was found that it had so conducted its affairs as to become a subject of blackmail or purchaser of protection.

When the unlawful and unfair railroad rate, the rebate, the drawback and the midnight tariff were investigated, they were found to exist as a result of a demand by some unlawful enterprise that had the power to demand and the shamelessness to exact such unfair and illegal privileges from the railroads of the country.

It was when the people came to realize these conditions that they came to understand the importance of bringing about a changed condition in our commercial and industrial life. They found those conditions of illegality and unlawfulness were finding their expression in the public life of the nation and state in the corrupting and debauching of the public servants.

These conditions, which the people have now come to generally recognize as being true, furnish my reason tonight for talking to this intelligent audience upon such a dry subject as the subject of "Combinations." And in order that I may be entirely fair with you, like the prestidigator, I will say that I have no large sleeves or false beard to conceal my movements, and that what I shall talk about is a question of modern industrial trusts with which we are now forced to deal.

Now, this is a subject which would seem already to be exhausted by the great mass of written and verbal discussion that has been had concerning it in the past ten years. But it is by reason of the fact that there has been so much said about the subject that it is still open to discussion and debate; because much that has been said concerning the industrial combinations has been said, not for the purpose of enlightening the people, but to confuse them concerning the principles which should direct their solution and settlement by the courts and legislatures of the country. There has been carried on during the course of the last ten years a general debate as to whether trusts were a good thing or a bad thing for the public welfare, and for trade or commerce. Now, the question as to whether it would be a good thing, that, whether it would be a sufficiently good thing to justify the apparent moral wrong for those who do not have horses to take horses from those who have more horses than they really need, would not be regarded as a question upon which there could be a serious difference of opinion. To go further, the question as to whether it would be a good thing, that is, a sufficiently good thing, to justify the apparent moral wrong for those who have horses beyond the necessity of their use to take horses from those who have hardly as many as they need, would also be a question concerning which there could be no serious difference of opinion. But, notwithstanding this fact, there has been conducted in this country for the last ten years, through every avenue of expression and public discussion, a general free-for-all joint debate on the question as to whether it is a good thing or a bad things for those individuals and corporations who have much of the world's wealth to take from those who have little of the world's weaith their money and their property by means which the law denounces as unlawful and contrary to the statutes and the common law of the states. (Applause.)

This question, I say, has been the question we have heard discussed so much in this country, and the difficulty in the controversy has been that we have undertaken to look upon the question rather from an economic than a legal standpoint. There has never been any question from a legal standpoint but that all trusts were bad trusts. There has never been any question from the legal standpoint but that when a man entered into a combination in restraint of trade or competition; that when men entered into a combination or agreement by which some man in a distant city could say to the farmers of Missouri how much they should receive for their produce, there has never been any question in law but that those men were committing a crime and should be punished like other criminal offenders at the bar of justice.

It is interesting, in view of the present attitude upon this question, to look back upon the last decade through which we have passed and to consider why it is that there has been such a befogging of the public mind upon a proposition concerning which there should have been no controversy.

This is the result of two conditions. After the close of the war between the states this country entered upon a most remarkable period of material development. That period has witnessed the reclamation from a desert west of that territory lying between the Mississippi and the Sierras. It has witnessed the development of our internal and foreign commerce in a measure unprecedented. It has witnessed the growth of new industries and the development of the old. It has been a period of prosperity unequalled, perhaps, by any in the history of the civilized world. It has been a period in which we have seen the new development in person of the modern captain of industry. And you can all remember when a man who could form into one combination a number of competing enterprises was called a captain of industry and had his picture in all the newspapers and magazines as an example to be followed by every young man. He still has his picture in the magazines and newspapers, but the tenor of the article concerning him has changed in recent years.

The lawyer who could form these large corporations was held up as an example to the young lawyers of the country, and his enormous fees for doubtful legal services were given to the anxious and eager public as a choice article of news. That lawyer still has his picture in the newspapers, but it has not been in exactly the same column as it was years ago.

These conditions came about on account of the fact that we were so busy making money that we were indifferent concerning the methods that prevailed in the world around us. What difference does it make to me, the farmer would say, if I must pay ten dollars more for a piece of machinery than I did a year ago? Am I not now getting eighty cents or a dollar for wheat, while a few years ago I was glad to get forty or fifty cents? Am I not getting higher prices for hogs and cattle than I was a few years ago?

The laborer would say, what difference does it make to me if I must pay seventeen cents per pound for beef, where I paid only fourteen cents a year ago? What difference does it make to me if I must pay twenty cents for oil (costing only two cents per gallon), while I could buy it a few years ago for fifteen? Am I not making nearly twice as good wages as I was a few years ago?

And so in this period of prosperity we did much to support the statement sometimes made that the American people are incapable of moral indignation.

But this is not all that blinded the people to the principles of the question of the modern trust. In this controversy as to whether trusts were beneficial or injurious, the brightest an dablest minds money could secure were engaged to support the propaganda which had as its foundation the theory that combinations of competing enterprises were good things for the people, because they cheapened the cost of production. These arguments were made by these paid advocates of combination, and were offered upon the authority of apparently distinguished sociologists and economists.

Let me give you one example of these arguments in behalf of the principle of combination written by one of the ablest exponents of the modern trust, Mr. S. C. T. Dodd, general solicitor of the Standard Oil Company, in justification not only of that organization, but of all combinations. He said that "to stop the congregation of individuals and aggregation of capital would be to arrest the world's progress and stay the march of civilization to a degree almost beyond comprehension. You might as well attempt to stay the formation of the clouds, the falling rain, the flowing stream as to attempt by any means to prevent the combination of industry, the association of persons and the aggregation of capital to any extent that the ever-growing trade of the world may demand. If there is one thing," he continues, "that history plainly teaches us, it is that abuses are soonest reduced to a minimum by permitting and not by restricting industrial liberty. Give to all equal opportunity and business will regulate itself on business lines. I do not prophesy an era of perfection. (You will note Mr. Dodd is conservative.) The golden age of the future is a mirage just as the golden age of the past is a myth. But those men whose integrity is such as to cause people to trust them with large capital, whose ability is such as to enable them to command the markests of the world, are soonest to realize that the policy which succeeds is that which assures fair treatment to all, be they consumers or producers, customers or employes, and that there is none so false or fraudulent as not to see that honor is the foundation of business."

Yet, these men, who are presented as representatives of honor and honesty, according to the sworn testimony of a witness in the case of the State of Missouri vs. the Standard Oil Company, on the second day of June, 1901, direct one L. E. Terrell, an employe of the Standard Oil Company, to sign a fictitious name and address to the articles of incorporation of the Republic Oil Company, in order that it might not be known as subsidiary association of the Standard Oil trust. And yet these men say whose genius is such as to enable them to command with their products the most of the world can be entrusted with the authority to control the interest of employes, of producers and of consumers alike.

Let me give you another statement, which is a statement of the law on the proposition, which I have taken the trouble to prepare for the purpose of giving to you tonight. In an opinion, written by a descendant of that great man who first pronounced those principles which moulded the warp and the woof of our national life, and who established the balance between the states and the nation in our dual system of government, a descendant of the great Chief Justice John Marshall, our own Judge Marshall, speaking for the Supreme Court of Missouri in the case of State ex rel. Attorney-General vs. Armour Packing Company, said:

" 'Competition is the life of trade.' Pools, trusts and conspiracies to fix or maintain the prices of the necessaries of life strike at the foundation of government; instill a destructive poison into the life of the body politic; wither the energies of competitors; blight individual investments in legitimate business; drive small and honest dealers out of business for themselves, and make them mere 'hewers of wood and drawers of water' for the trust; raise the cost of living and lower the price of wages; take from the average American freeman the ability to supply his family with necessary, adequate and wholesome food; force the boys away from school and into the various branches of trade and labor, and the girls into workshops and other avenues of business, and make them bread winners while they are yet almost infants, because the head of the house cannot earn enough to feed and clothe his family.

"The people are powerless to protect themselves. The powers that be must protect them, or as surely as history records the story of republican government in Rome, so surely will the foundations of our government be shaken and its perpetuity threatened.

"(A long line of decisions) have held statutes which prohibited such combinations or trusts to be constitutional, and further, that all such combinations or agreements are against public policy and void at common law, and as a matter of American common law, irrespective of whether there is any statute on the subject or not."

That is the voice of the law when it speaks of commercial greed and aggrandizement. That is the expression of the court. Notwithstanding the fact that the common law had never been uncertain on this proposition of trusts, notwithstanding the anathemas of the legislatures and the courts, they have continued unchecked and unhampered in their growth and development.

It was only when the people realized that these abuses, to which I have referred, were caused by some business enterprises unlawful in its plan of organization and illegal in its business methods that they awoke to realization of the principles of morals and law involved in the conduct of their commercial and industrial life. Further than that, they came to realize the effect of having a large part, if not the major part, of their trade and commerce conducted by stealth, by lying and cheating, and by the violation of every principle of honor and fairness. It was only when the people realized the effect of these conditions upon our national life and character that they resolved to return to the principles of the common law and common honesty in the conduct of our commercial and industrial affairs.

Take the Sherman Anti-trust Law, for instance, which was enacted in 1890, making combinations in restraint of trade both a civil and criminal offense; and yet, during the first twelve years of the existence of that law, but twenty-six suits were brought under its provisions, of which only ten resulted in favor of the government. Of those ten six were against common labor organizations, and of the remaining four two were against railroad organizations.

There have been more prosecutions begun and more successful results secured during the course of the last four years than had been secured during the entire previous existence of the law. Now, this is not by reason of any accident of administration, although the personnel of administrations has much to do with the effectiveness of the laws. But however honest or capable a public officer may be, he must have the sustaining influence of public opinion in order to make our laws virile and effective.

It was only when the people came to realize the moral principle involved in this question of combinations that they re-enacted the Sherman Anti-trust Law in vitality and influence. Very probably you young men, who are engaged in the pursuit of that great profession, have been told by your instructors in the law school that law is a rule of external human action which a superior political power will intervene to enforce. I say to you that when it comes to its practical working and effect, law is but a concrete expression of the moral instincts of the age it controls. And when the people of a state or country come to a realization of the fact that things which have been done in the past and viewed with indifference are immoral, unfair and illegal, those practices must and shall come to an end. And it was this public sentiment that has re-enacted this law into force and made prosecutions under its provisions possible of success.

What will be the result of this change in the public feeling? I do not undertake to say. I simply know from the standpoint of one who has been engaged in considering the practical side of this question that there must needs be a clear conception of the moral and legal principle from the standpoint of the public.

I have already indicated to you clearly the proposition that any combination in restraint of trade and commerce was both at common law and by the provisions of the Sherman Anti-trust law and the laws of most of the states, a criminal offense, subject to be prosecuted by indictment or information and punishable by fine or imprisonment. In the State of Missouri, by some peculiar accident of legislation, we have no law by which a combination in restraint of trade, no law by which a trust, no law by which those who form or carry on a trust, can be punished as they can for other crimes or offenses against the person or property. Indeed, our present statute against conspiracy would support the argument that the common law in reference to conspiracy in restraint of trade has even been repealed in this State by the legislature. But I undertake to say that our present legislature will not permit that defect to remain in our laws after it has completed its labors.

But we must come to an understanding of the proposition that when any man or combination of men, that when any corporation or combination of corporations, takes from the American people their money or their property, either by giving them less than they should receive for that which they sell, or by charging them more than they should pay for that which they buy, that such men or corporations are just as clearly committing the offense of larceny as the burglar who enters your house or the pickpocket who takes your purse.

I say to you that the five or six men, who, sitting in a distant city, can, by the formation of a combination between them, say to the farmer of Missouri, "You shall receive so much and no more for the cattle you sell," and those same men can say to us who are consumers and not producers, "You shall pay so much and no less for the meat you buy for yourselves and your families" —those men, I say to you, are committing a violation of the law of this country; they are committing a violation of the principles of the common law; they are taking from the American people their money and their property by means that are immoral, unfair and unlawful; and when we have come to a realization of the fact that men are committing a criminal offense, then have we made a marked advance in the settlement of the question of the trust.

I am not here to say that civil litigation has not been without its benefits. Because it would be a mere matter of speculation to undertake to say how much worse conditions might have been had the officials in the past not undertaken to do that which they could do by injunctions and actions in *quo warranto*. But whenever our laws are so enacted as to meet existing conditions, by which such offenses can be punished by criminal prosecution, then can we accomplish both moral and practical results; then will men of respectability be unwilling to gamble upon the chances of a jail sentence for financial profit from business conducted in an unlawful way.

Now I do not want to be unfair to the modern business man; unfair to those engaged in the actual conduct of the business enterprises of the country; nor do I wish to be understood as indicating that the American people are opposed to wealth as such, or to large enterprises or undertakings. The American people realize today, as they have always realized, and as history has taught them, that commerce is a great educator, a great builder and a great civilizer. They know that Byzantium and Carthage, Babylon and Tire rose and fell with the growth and decay of their commerce. They know that Athens gave to the world her imperishable gifts of art and architecture and literature when her harbor was filled with the trade of the Mediterranean. They know that Rome rose to the zenith of her glory and power when her market place was filled with the products of the civilized world and her galleys sailed in every sea. They know that Venice and Florence were magnificent in art and architecture and painting and music when their factories were swarming with artisans and when bazaars filled with the products of every land. They know that England became the mistress of the sea and an empire upon which the sun never sets, not alone by the strength of her armies that have marched upon every land, of the power of her navies that have sailed all the seas, but by commercial and industrial greatness, which has made her the clearing house of the world. The United States of America commanded the respect of all nations when George Dewey sailed into Manilla Bay, and again when that thin blue line dashed across the Spanish trenches at San Juan and El Caney. But we commanded more respect when, by reason of our industrial and commercial greatness, we demanded admission to the counsel chambers of Europe and became an arbiter of the world's destiny; when the President of the United States, the one man of all the rulers of the world whose word might be heeded, looked across the broad expanse of the Pacific and saw an awful contest being waged there which was staggering humanity by the waste of men and treasure. And he, by reason of our commercial greatness and power, was able to reach forth his hand and stop that awful carnage of blood. These were some of the triumphant claims of industry and commerce. There is no prejudice against wealth or large industrial undertakings in the attitude of the American people when they demand that business should be honest and honorable, even though they admire business which is great and magnificent of proportion. They simply demand that those old-fashioned principles of common honesty apply in large corporate affairs as they apply among individuals in small affairs.

Now I would be insensible and violate the conditions which are incident to youth and the future which belongs to youth if I should attempt to pronounce a hopeless prediction as to the future. I say to you that I believe that the American people will be capable in the future, as they have proven themselves, to be in the past, of dealing with any question our national life can produce. I believe they are prepared to approach the consideration and settlement of these great questions produced by the conditions of our commercial and industrial life. I believe they are prepared to approach this consideration and settlement with caution and deliberation; the pitfalls and the obstacles that vested wrongs, masquerading under the name of vested rights, may place in their pathway cause them to seem to falter and to hesitate; but they will not falter, they will not hesitate, they will proceed. They will proceed in such a way that no one can truly say that a single dollar invested in honest enterprise has suffered diminution in its value.

I do not believe that socialism or governmental ownership offers a solution or a remedy. I do not believe that we would benefit ourselves by resolving ourselves to that natural state in which each would give to all the produce of his own labor and his own mind. But I do not believe the present condition, in which a large part, if not the larger part, of our trade and commerce is unlawful both in its plan of organization and the methods in which it is conducted, can continue. I do not believe that our present industrial system can continue half lawful or half unlawful. It must be legally and fairly conducted if it hopes to survive.

I do believe that the American people, rising equal to this emergency, will see that the unlawful shall cease and conform itself to the laws that represent the experience of centuries and the moral judgment of eighty millions of people. And I believe that this result will be accomplished not by any legerdemain or trick of finance; not by any radical departure from the beaten paths and the precendents of legislation and executive action. I believe it will be accomplished as the result of the application of the old time principles of common honesty and the demand that they shall apply again in trade and commerce. I believe that we will return to those old-fashioned princiaples of honest private and public life, which will require that the man who would be regarded as respectable must be honest; which will require that those who would be respected by others must respect the rights of others; which will require that lawyers shall cease to be accessories to the violation of law and shall be true to the principles and traditions of their profession; which will require that the courts shall cease to place the form above the substance and the method above the right, and that they shall realize that time is also an essential of litigation; which will require that every public officer, charged with the enforcement of the law, shall unhesitatingly, uncompromisingly and unrelentlessly prosecute its offenders, until the rights of the poor shall receive the same protection as the property of the rich, and the weak and the strong shall stand as equals before the bar of human justice. (Applause—continued.)

SESSION

Missouri Corn Growers' Association

January 10-11, 1907.

PRESIDENT'S ANNUAL ADDRESS.

(E. E. Laughlin, Rich Hill, Mo.)

When the Roman army came home triumphal arches were built in commemoration of the deeds of greatness done. The colonnades showed the death of the foe, the misery of homes, for the greed of Caesarian rule; on the arch, inscriptions of valor or battle cries. Suspended from the arch hangs the disintegrating features of the fallen chieftain. As the warriors pass by the fierce bloodcurdling battle cry is heard.

We pass under the triumphal arch this day. Warriors not with the greed of Caesar, but carrying the message of modern warfare for the good of our empire. Colonnades not built from wreck and ruin but improved corn, which means improved soil, improved live stock.

On the colonnades are inscriptions of valor and success: The Institute Corn Show; The Boys' Corn Growing Contest; The State Fair Contest. The masterwork of the arch is built of our beautiful corn laying in State Show. Our inscriptions on the arch, our battle cry "Missouri Corn," "Increase the Yield," "Improve the Quality." Our trophys, visible and invisible, not the loathing sight of death, but an inspiration. In all battles for victory master minds must general. In these we have Mr. Geo. B. Ellis, representing the State Board of Agriculture, ever ready when advancement is the call; Dr. H. J. Waters' inspiration never found wanting; ex-Governor Colman hurling the challenge, selecting the field. Let us do honor to our own Secretary and the success he has brought us. These enlisted generals for better Missouri corn have been mighty of word and act. How many more for next year? Our army is increasing. We need more—stalwart and strong. The advancement these men and others inspired is written and sealed in the great colonnades supporting the triumphal arch of Missouri corn.

It is gratifying the interest shown in the State contests. These contests are the barometers. How many hundred boys, hearing parents talk better corn, read about better corn, resolve to grow better corn. Almost ready to write, entering the contest, still not. We see how many have already resolved and actually entered the race. Just what we are after! Five hundred farmer boys to champion the silent thousands that have been in the race. Our institute men report that at each place of meeting some father says: "My boy is in the State contest." These contests are the barometers, and we read high pressure. Let us interpret history aright. If conquest is an ingrown desire, let us lay the field of action. Furnish the inspiration, not in death and misery, but in competitive shows for better corn.

Our State is learning variety and color to suit the locality. Surely the farmer is behind the times when shelling corn for the calves that mixed cobs fall away from the sheller. It is not enough to have all our crop uniform in shape and color, both in grain and cob or in stalk.

But we are now ready for the finer arts of breeding in plant life, particularly in corn. Time has changed variety simply by selection. The art of the breeder is more than selection; it is hand fecundation. The skillful use of the emasculator must be practiced if advancement is our aim. Within the broad arms of the Missouri Corn Growers' Association is needed a small body of earnest seed-corn breeders—men that are ready to sacrifice for the good of their fellowmen. For in seed-corn breeding, to get pecuniary reward from effort, we lose control of the stock, which cannot be patented or restrained. Right here with these men our State can ill afford to tighten her purse strings.

Within our memories, cattle in Southwest Texas could have been bought for one dollar per head. Now, after years of breeding —not of female selection, but by emasculation—along with commercial causes, these cows sell for $50 per head. Five thousand per cent has been added to their value. Can we, by like ways in plant life, do what has been accomplished in animal life in the short space of forty years? Why are we not sure when planting three kernels in a corn hill three full ears, field conditions being right, to produce 75 bushels per acre, or each ear reduced equally of 25 bushels. This we know we will not do in field practice. One good ear in a hundred; 99 nubbins. Who of our swine breeders would tolerate such variation in size and litter? Still corn growers permit this to go on from year to year. This condition is easily explained. We do not breed it so—we select it so. One outstanding ear in a thousand. The box on the side of the wagon is the receptacle for the choice ears for next year's seed stock. The male-producing propensities in plant life is strong by profuse pollination, reducing vitality of stalk to barrenness or nubbin production. In live stock strength of male is "survival of the fittest." This is where, by not allowing these worthless progenitors to run rampage through so-called well-bred seed corn, we expect to "increase the yield," "improve the quality." Yes, we have selected our corn to its standard, good and well; but let us eliminate nubbin producing stalks by breeding. Our legislators are ever ready to aid the people if they see cause. Can't we show them that Missouri corn and prosperity go hand in hand? Can't we show them that fine farms, happy people, come from good crops? Can't we show them the possibilities of a single corn hill multipled over the entire State? Then let us up and doing.

There is no reason why a pound of either protein carbohydrates or fats in corn will not bring as much as in oats, wheat or rye. Therefore, it is a matter of only a very few years when an 80-bushel corn crop will sell for the price at which the land is bringing today. In section 4715, chapter 67 of the Revised Statutes, the Missouri State law gives the county judges the right to donate $150 for the advancement of agriculture. There has been no provision to utilize these funds except through private gains in county fair corporations. Why not suggest to these judges, through the co-operation of the Missouri Corn Growers' Association, that this money be distributed over the county as a partial compensation for work done in tabulating and bringing to notice these experiments in corn or other crops. Surely, it would become a popular move with good results. Three hundred years ago the first corn talk was given by Powhattan in Jamestown settlement, which must have gone unheeded. Starvation continually harrowed to death until the corn cribs were filled. Longfellow's "Hiawatha" says:

> "All around the happy village
> Stood the maize field green and shining,
> Waved the green plumes of Mondamin,
> Waved his soft and sunny tresses,
> Filling all the land with plenty.

"'Twas the women who in springtime
Planted the broad fields and fruitful,
Buried in the earth Mondamin.

* * * * * *

"Once when all the maize was planted
Hiawatha, wise and thoughtful,
Spoke and said to Minnehaha,
To his wife, the Laughing Water,
You shall bless tonight the corn fields;
Draw a magic circle round them
To protect them from destruction,
Blast of mildew, blight of insect.
Wagemin, the thief of corn fields,
Paimosaid, who steals the maize ear,
In the night when all is silent,
In the night when all is darkness,
When the spirit of sleep Nepa win,
Shut the doors of all the wigwams,
So that not an ear can hear you,
So that not an eye can see you,
Rise up in your bed in silence,
Lay aside your garments wholly,
Walk around the fields you planted,
Round the border of the corn fields,
Covered by your tresses only,
Robed with darkness as a garment;
Thus the fields shall be more fruitful.

* * * * * *

"'Twas the women who in autumn
Stripped the yellow husks of harvest,
Stripped the garments from Mondamin,
Even as Hiawatha taught them.
And whene'er some lucky maiden
Found a red ear in the husking,
Found a maize ear red as blood is,
'Nushka'! cried they all together,
'Nushka'! You shall have a sweetheart,
You shall have a handsome husband".

How crude this great problem of crops! We have gathered together the fragments of useful information of three centuries, and today stand together under the triumphal arch of better Missouri corn.

Let us select corn. Let us breed corn. Let us show corn. Let us say to ourselves: *If ashamed to show be ashamed to grow.* But hum, not "an old love tune," but rather one of our own liking: "*Glad to grow* and *glad to show.*"

THE SEED AND THE SEED BED.

(A. M. Ten Eyck, Professor of Agronomy, Kansas Agricultural College, Manhattan, Kansas).

Mr. Chairman and Farmers of Missouri: You have a long program, and I do not want to lengthen the talk on this subject above what will be necessary, in order to present a few of the important principles on the subject of "The Seed and the Seed Bed."

Good seed is the first requisite in producing large yields of crops of any kind, and when I speak of good seed, I mean more than simply seed which will sprout and grow—I mean seed of a variety adapted for growing in a certain soil and climate—I mean pure-bred seed, or at least, well-bred seed of that variety, and this is hard to find. We have the term "pure bred" corn; but any of you who have grown it know it is not pure bred. In my judgment, it will take a long time yet to make pure bred corn, and then the breeders will always have to fight to keep it pure bred.

And this is true of other crops raised on the farm, that they are all badly mixed. Take wheat, for instance. Kansas is one of the great wheat producing states in the Union, and yet I find in traveling over the state and observing the samples of grain exhibited and delivered at the elevators, that we have practically no pure-bred wheat. It is all mixed. I have never discovered a sample of pure-bred wheat. There is some well-bred wheat, and some farmers are doing careful work in grading their seed wheat and keeping their seed grain as pure as possible, but there is no pure-bred seed to start with.

That is the difficulty.

We find in the comparative tests of varieties of corn, wheat, oats and other farm crops at the Kansas Experiment Station that there is a great difference in the yield and in the quality of the grains produced by different varieties.

In 1904 some thirty different varieties of winter wheat were grown in small plots side by side. The soil was practically the same. All grain was sown on the same day, at the same rate of seeding, and the crops given exactly the same culture and treatment, and yet the yields of grain from those plots varied from nineteen to thirty-seven bushels per acre. The experiment was repeated in 1905 on a little better piece of land; perhaps, too, it was a little better year for wheat. The yields varied from thirty-one to forty-seven and a half bushels per acre, and the difference in the grade and quality of the grain was as great as the difference in the yield. Some of the inferior producing varieties were discarded and the test repeated again in 1906, the resulting yields ranging from thirty-nine to fifty-one bushels per acre. A few of these varieties have proven superior to others and much better adapted for growing in our soil and climate. I will name several of these: Kharkof, Malakoff, Red Turkey, Bearded Fife, Red Winter, Defiance, the Zimmerman and Fultz.

These include only two different types of wheat. The first six varieties named are the hard red winter wheat, the last two are the soft red wheat. Certain types or varieties of wheat are adapted for growing in certain sections of the State. In Eastern Kansas, especially on the bottom lands, the soft red wheat grows well, while in Central and Western Kansas the hard red wheat is most successfully grown. Variety testing must be more or less local in order to determine which are the best varieties to grow. Yet the general tests made at Manhattan indicate what varieties may be best adapted to certain localities. Much the same work is being done with corn and other crops, with similar results.

In our tests with oats three varieties out of some thirty tested have given decidedly the larger yields. These are: Sixty-day, Kherson and Red Texas, and these varieties of oats are also proving to be good producers in other parts of the State. Out of some eighty different varieties of corn tested during the last four years, eight or ten varieties may be selected, which are decidedly better than the average, and which have given larger yields, with a better quality of grain than the other seventy varieties. There is no question but that there is a great difference in varieties in their adaptation to different soils and climates, and it should be the purpose of the State Experiment Stations, with the help of the farmers and the sub-stations, to determine what are the best producing varieties for the State and for the different sections of the State.

A great deal of this work of variety testing has been done in several states, but usually with very little result. I found, on studying up this question recently, that while some states had tested a great number of varieties of standard crops through a long period of years, sometimes as long as ten years. and had finally made a report showing that certain varieties were the best producers, that today those varieties were not grown at all in that state. The tests had been made and the seed simply thrown away. Such work has very little value. Just to know that a certain variety is better than another does not help the farmer unless he can get the seed of that variety and plant and grow it. You want some of the seed of that best-producing type of corn, wheat, oats or barley, and it has been my plan at the Kansas Station not only to test varieties, but as soon as I am satisfied that some varieties are better than others, the seed is planted in increased plots and multiplied in quantity, and distributed to the farmers of Kansas at a nominal price.

Prof. C. W. Burkett, director of the Kansas Experiment Station, remarked in a recent address that if a pure-bred hog sold for two or three thousand dollars, and was worth it, and breeders were willing to pay that price, that a bushel of pure bred wheat, which had been carefully selected through generations previous to the production of this bushel, was worth, in comparison to the ordinary wheat, just as much as the fancy bred hog was worth in comparison to the ordinary hog.

There is no question but that as we get these varieties separated, as we get them pure in type, we have something better than the average—something that is far better than the farmers of the State are growing. The distribution of better seed in Kansas has already given good results, and many compliments have been received from the farmers regarding the greater productiveness of seed grain sent out from the station.

Thus the work of the Experiment Station is not only to test varieties, but to breed crops, increase the seed and get it out among the farmers of the State. In the last two years the Agronomy Department of the Kansas Station has sold and distributed some 1,500 bushels of good seed wheat, several hundred bushels of good seed oats and barley, and five or six hundred bushels of seed corn of good varieties—not pure-bred, but better than the average. Meanwhile, we are attempting to still further improve these better varieties by breeding and selection. I will not go into the details of the work along that line. You will have in this meeting the subject of corn-breeding presented to you, and the "ear-row" method of breeding will be discussed, by which the breeder is able to secure a purer type of corn by selecting the individual ear and making it the foundation of the new and improved strain, and thus increase the yield and improve the quality and type of that corn. Also, the same kind of work may be done with wheat, Kaffir corn, with sorghum, with oats and barley, and almost every crop the farmer grows.

At the Kansas Station we are breeding several of these crops by the "head-row" method. The best heads of wheat are selected in the field—heads that are alike and pure in type. Each head is shelled separately, and only the grain of the better type and quality is saved for planting. By this method of selecting like heads of apparently the best type and planting this seed in separate rows, we hope to be able to select the individuals which will be the founders of a purer, higher producing strain of wheat, better adapted to our conditions of soil and climate than the average wheat from which the selections were made. You see there is a great field in this plant-breeding work, which we are only just touching in the subject of corn. It is wonderful and a very interesting field of work, and I believe we are going to do more for agriculture in this line of crop breeding in the next twenty years than we can imagine right now. There is a great opportunity to breed better seed by improving the best varieties we already have, by breeding pure strains, or new varieties, as we may call them, though practically they are just strains of the sorts we are growing today. I will not go into further detail on this subject of crop breeding, because it will be further discussed in talks following this.

VITALITY OF SEED.

It is necessary that the seed which we plant be not only well bred but strong in vitality. The seed which is nicest in appearance may not necessarily be the strongest in vitality. We have found with corn that it is not always possible to judge an ear as to its vitality. A good judge may make a fair guess. He would discard ears which contained molded, decayed or immature kernels. He would suspect the vitality of certain ears of corn if the kernels had broken tips or a dull color, and sometimes he would be correct. But at the Kansas Station I have picked out from a crop of twenty acres of corn fifty of the best ears the eye could select and tested them separately as to germination, and found that the kernels would not all germinate. There seems to be in an ear of corn an inherent quality which has something to do with its vitality and its reproductiveness, and the only safe way to determine whether corn is good seed corn or not is to test the germination of the kernels of every ear before planting. That looks like an awful big job to Kansas farmers, and I am almost afraid to present it to them yet, and I want to get them started by persuading them to test simply the ears they intend to use in their seed plats. But when we find that in 100 ears of well-selected seed corn a half dozen or more ears may be discovered by the germination test whose kernels will not sprout, it is evident that each individual ear should be tested and proven good before planting, in order to secure a perfect stand. This is one of the ways of getting a large crop—to have a perfect stand.

With other kinds of grain I have not made experiments to test this matter of germination, so far as the individual plant is concerned. But with all kinds of grain it is safer to make a general test of the germination before planting. This is not so necessary with wheat, oats and barley, but especially important with the smaller seeds, clover, alfalfa and grass seeds. It is a great risk to plant grass seeds without first testing the germination. A simple germinator may be used for this purpose: a shallow box, three or four feet long, by two or three feet wide, about two inches deep, filled full of sand or soil makes a good germinator. Count out a hundred, or perhaps a thousand seeds, and scatter them over the sand. Press the seed lightly into the sand or soil, water thoroughly and cover with a wet cloth or folds of wet paper, and protect this with a light cover of boards to prevent evaporation. Place the germinators in a warm room. It may be advisable to water again in two or three days. After five or six days, with most seeds, the vital seed will have germinated and may be counted, and the percentage of germination determined. The same germinators answer very well for testing individual ears of corn, provided small wires are stretched aross the box, laying the surface off in squares of about two inches, which may be systematically numbered. The importance of good seed can hardly be overestimated.

THE SOIL.

The breeding of crops is a part of our agriculture, which, up to this time, has been largely neglected. Crop breeding is new, and we are interested in breeding corn, in breeding wheat and in breeding all the standard crops. But there are other factors which are as important, or even more important, in the production of any crop than good seed. You may plant good seed of the purest varieties in an infertile soil and you will get a poor crop. You may plant the very best seed in fertile soil, which is in poor physical condition, or neglect to give the proper culture during the growing season, and you cannot produce the best corn, the best wheat or the best oats. It is even more important, in my judgment, to make the proper conditions in the soil for growing the crop when we plant well-bred seed than when we plant any old scrub stuff. It is the same way with crops as with stock. Anything is good enough for the scrub animal. He does not need much care. He will hustle around over the prairie or live in a straw stack all winter, and it does not make much difference if he dies. But we cannot afford to neglect well-bred stock, and we do not. We give it the best kind of care with good feed, and we make the animals larger and better by feeding them properly and giving them the right care. The blood is, of course, an important factor. It is the beginning, but the "blood" must be given the proper conditions in order to have the animals develop properly and it is the same way with good seed. It must be given even better conditions to make and keep it what it is than are required to prevent further deterioration of the scrub seed. Often the scrub seed cannot deteriorate much any way. It's already as poor as it can get.

When a farmer becomes interested in pure-bred corn and plants it, he grows better corn and larger crops. If a farmer plants well-bred corn he takes care of it and gives it a chance to make a good crop. He is more likely to give the well-bred corn the proper cultivation, and it is necessary to secure the best possible conditions in the soil, and to give the best possible cultivation, in order to produce again the kind of corn that the well-bred seed came from. Nature never made an ear of corn such as we have today. I have never seen the native corn plant, and I do not know that I would know it if I saw it. I understand it grows down in Mexico on the plateaus. The wild corn has only a few kernels on the ear. We would hardly recognize it as an ear of corn. The present corn has been produced by giving it better conditions to grow in than the wild plant has. We have in corn today an artificial product which has been made under conditions which are co-relative with nature, but which are not entirely natural; and any crop will deteriorate if left entirely dependent on nature, without the help of man. Then, if we would improve our crops or keep them up to a high grade of perfection, we must have fertile soil and practice the best methods of culture.

There is no question but that plant food must again be added to the soil after it has been farmed a long time and the crops have taken out a large part of the fertility of the land. But I am not much of an advocate of the use of chemical fertilizers. I believe before we spend very much money for chemical fertilizers we ought to utilize the natural means God has given us to maintain the fertility of the soil. (Applause.) Those means are good tillage, rotation of crops and returning to the soil the by-products of the farm. The last is accomplished by feeding the crops on the farm, thus securing the manure, putting that back on the land, and in this way economically maintaining the fertility of the soil by these natural methods.

THE SEED BED.

When viable seed is planted in the soil a few simple factors largely determine the strength of germination, the stand and yield of the crop and the quality of the grain produced. These factors are moisture, heat and air. Every farmer knows that a dry seed will not germinate; no matter how favorable other conditions may be, before the processes are begun which start or renew life and produce growth, the seed must absorb moisture. Again, every seed requires a favorable degree of heat before it will germinate, and the presence of air is necessary in order to supply the "life-giving" oxygen. A seed placed in a vacuum with the proper degree of heat and moisture will not germinate, and the same results often occur when seeds are placed in a very wet or water-logged soil, because the air is largely excluded from a soil in such condition.

In order to secure the ideal conditions for seed germination and plant growth, a seed bed for planting all kinds of small seeds should not be too deep and mellow, rather the soil should be mellow, but finely pulverized, only about as deep as the seed is planted. Below the depth at which the seed is planted the soil should be firm (not too compact), making a good connection with the subsoil, so that the subsoil water may be drawn up into the surface soil. The firm soil below the seed, well connected with the subsoil, supplies moisture to the seed, while the mellow soil above the seed allows a sufficient circulation of air to supply oxygen, and favors the warming of the soil, gathering the heat of the sunshine during the day and acting as a blanket to conserve the soil heat, thus maintaining a more uniform temperature in the soil during the night. Meanwhile, also the mellow soil conserves the soil moisture, acting as a mulch to keep the water from reaching the surface, where it would be rapidly lost by evaporation, and the same condition favors the growth of the young shoot upward into the air and sunshine, where, in the presence of oxygen light, and a favorable degree of heat, the green leaves quickly begin the work of assimilation and the soluble plant-food elements absorbed by the roots are rapidly transformed into protoplasm, starch and the various tissues which build up plant structure, and the young plant grows and is soon firmly established upon its own roots.

With a deep, loose seed-bed the conditions are less favorable for seed germination than in the "ideal" seed-bed described. The mellow soil may be warm enough and well aerated, perhaps too well aerated, causing the soil to dry out, but with the deep, mellow seed-bed the moisture in the subsoil is not available for the use of the germinating seeds, because the capillary rise of the water is checked at the bottom of the mellow soil. Such a seed-bed is almost wholly dependent upon rain for sufficient moisture to germinate the seed and start the young plants, and even if such favorable weather conditions prevail at seeding time so that seeds may germinate and the crop start, yet at almost any time during the growing season, if drouth prevails, the crop growing in the deep, loose seed-bed is more apt to be injured because of the rapid drying out of the surface soil. In such a seed-bed the crop is not only apt to "burn out" in summer, but it is also more apt to "freeze out" in winter than a crop grown in the "ideal" seed-bed described above.

I cannot here go into detailed discussion as to methods of preparing a suitable seed-bed.

An excellent seed-bed for small grains or grasses may be prepared without plowing when these crops follow corn or other cultivated crops, simply by disking and harrowing.

When the plowing precedes the sowing by a short interval, it is well to follow the plow with the sub-surface packer and harrow, in order to pulverize and pack the soil at the bottom of the furrow and leave a mellow surface. This packing and pulverizing of the furrow-slice is especially necessary when the soil is plowed dry, or when stubble, trash or manure are plowed under, because if the furrow-slice is left loose and unpulverized, the capillary connection of the soil with the subsoil is largely broken off, and the soil water will not rise into the surface soil to supply the germinating seeds and feed the roots of the young plants, hence the seed fails to germinate well, the stand is often poor, and in such a seed-bed the crop "freezes out" during the winter or "burns out" during drouth in summer.

The general experience of farmers and the results of experiments are much in favor of early plowing for fall wheat. And it is preferable as a rule to plow in the fall for spring seeding of grasses and early grain crops.

Q. What is the best way, in your opinion, to get that pulverized condition of the soil next to the subsoil?

A. In wheat culture, we have three different methods in Kansas. One of the most common and most practical is to plow early; that is, as soon after harvest as possible. That gives a long interval in which the soil can store the water. But this is helped out a little by harrowing, perhaps, right after plowing—and then every two weeks or ten days, or if it rains hard, the harrow goes over it. Always ride the harrow—that is a lazy way to do, but it helps to settle the soil and loosens the surface deeper, so that the soil may take in the rain, and is less apt to wash or blow than shallow harrowed land.

Q. Is not disking before plowing very beneficial?

A. Yes, that is helpful. That brings up the second method of disking soon after harvest, and, perhaps, repeating the disking once or twice, and then plowing. By disking the soil is kept in ideal condition to take in the water.

Q. You seem to recognize the idea that it is advisable to disk before plowing. I would like to ask the question, would you use a large disc or a small one?

A. I am a little undecided in regard to that. We use a medium sized disc in preference to a larger one—something like fourteen inches, I think. The smaller disc will certainly do more pulverizing.

Q. Do you think a small disc goes sufficiently deep?

A. I think so. The 14-inch disc would go sufficiently deep. The third method of preparing the seed-bed for wheat is the listing method. When a farmer farms so much land that he can not plow it all each year, he starts a lister after harvest and lists out the ground. There are two ways in which to finish the seed-bed. One is to list again, splitting the ridges and leveling the ground with the disk and harrow. The other is to work the soil back into the furrow with the disk and harrow without any more listing. Usually the farmer has time to list only once, disk once or twice and harrow once or twice. By that time he has worked the soil back into the furrows and has leveled the seed-bed. This is an ideal way to catch and store the rain. The furrows take the water right into the subsoil, where it belongs, and the after cultivation covers it up with a mellow soil mulch which prevents loss by evaporation. I believe this listing method is a good plan in Central and Western Kansas, but in Missouri plowing would perhaps be preferable.

Q. Would you do the listing as soon after the harvest as you could? I presume you list your furrows as close together as for corn rows. If you list twice, how long would you wait before you list the second time?

A. I would advise to list again at once as soon as the first listing is finished. The difficulty is to get the soil settled by listing twice, and it is not commonly practiced.

Q. Would it not be advisable to disc after the first listing and then list again?

A. Yes, that should put the soil in a more pulverized condition.

Q. There is a question I had in mind in my first question which has not been brought out, and perhaps I did not make it plain enough. You seem to gather that I had in mind the idea of a seed-bed for wheat. I had in mind a seed-bed for corn. We often find litter on the ground, which we plow under. My idea is that the farmer raises nothing to burn, and what is on top should go under.

We put a lot of corn stalks and grass under whenever we find it. If the ground is hard on top, we get only the top pulverized. The question is what is the best method to get the ground pulverized and firm below in order to get that water up from the subsoil.

A. The earlier you can plow the better. Then the use of a disk and sub-surface packer is about all I can offer with reference to getting the bottom of the furrow-slice pulverized and well connected with the subsoil. If the ground is dry when it is plowed it is almost impossible to do this with any kind of a tool, and you must depend almost entirely upon Providence to give you enough rain to put the soil in good seed-bed condition.

Q. You do not advocate that we must depend upon Providence entirely though, do you?

A. No, not too much. Of course, we must depend upon Providence, but we must do our part. (Applause.)

THE FARMERS' BREEDING PLOT.

(S. M. Jordan, Stanberry, Mo.)

I would not make the world richer if I could, but I would make it better and happier. If in increasing our crop yields we increase our wealth only, we are making at least a partial failure. If increasing our yields means to lighten our burdens, to bring us more and better tools to work with, better houses to live in, and to fill them with more comforts, more music, more and better books, and time to enjoy them, then we are succeeding. If it means to put culture and refinement in our farm homes it will solve the great problem of keeping the best muscle, the best brains of the best boys and the best girls on the farm where they were born. It is this prosperity of generous intelligence that makes our people respond so nobly to calls for aid when disaster befalls our own and other lands. It is this magnanimity that shall awaken the slumbering voice of peace that shall be sounded and be heard around the world.

In this talk I am not going to tell you what I may do or what you may do, but what I have done. The average from my breeding patch might not be uncommon in a favorable season, but in one such as we had last year I think it very good. About one and a half inches of rain fell from before corn planting until the crop was made. On June 3rd about a half inch of rain fell, and I think the 28th of July we had about an inch of rain, so that the rest of the water required for the crop had to come from below. I began storing water for my breeding patch last fall. The ground had been in potatoes, and I turned them out with a lister, running it, perhaps, eight or nine inches deep; picked up the potaotes in sight, and then harrowed twice, picking up potatoes after each harrowing. Then I broke the ridges with the lister, running it about two or three inches shallower than I had run it when listing out the potatoes. Then I had the first and deeper hollows filled with loose dirt and ready for catching and holding the water from the last lister furrows. I am sure a harrowing after the last listing would have been still an improvement. During the winter I spread a light coating of manure over the patch. As soon as the ground was in good condition in the spring I harrowed, and would harrow as soon as ground was dry after rains, and on May 1st I plowed as deep as I could make the plow go; harrowed again, and my seedbed was ready, and it looked much like an onion bed after our wives have been at work in the garden awhile.

We will now go back to last fall and see about selecting the seed. I took a sack on my shoulder and began the hunt for 24 ears, the number I wanted for my plot. When I saw what looked promising in a stalk I first looked for a root system, and if I did not find good brace roots I just passed on; but if good strong roots reached out and to the ground I felt that a vital part was there to withstand both dry weather and wind; then I examined the stalk, and if I found good size to make it strong and long brood leaves to help pump water from the ground, I was ready to open the husk and see inside; and if I found a well-formed ear of fair size and approaching the requirements of a good ear, I put it in my sack, and so on until I had collected, perhaps, 300 ears. I would always make some mark by which I could distinguish those that come most nearly reaching my ideal. Then during the entire fall and winter I kept my eye open for the best I could find. I offered one man $10 for ten ears, but could not buy them. I feel sure I made good wages for all the time spent in selection. Having my seed ready and tested, I planted on May 14 a patch on the southwest corner of the field near the house. The patch was 24 hills wide and fifty-four hills long, three feet 8 inches apart; then one row or 54 hills makes one-sixtieth of an acre. If possible, I would put the plot near the house and on the southwest from other corn that may be near, for during the ten days or two weeks in which corn will mix our winds are generally from the scuth, southwest or west. Have it near the house that you may get into often. I mate my ears when I plant like I would my hogs, if I had all the males and all the females I desired to select from. I take the finer types for the rows I mean to detassel, and the larger ones that are rougher in outline for those I do not mean to detassel. Now, when I am ready to plant I select the ear from row No. 1, shell the corn off, as much as I will need, leaving both butt and tip and part of the rows unshelled; take a small square card board and mark it No. 1, and stick a six penny nail through it into the pith at the butt of the ear and put it into a box; when row one is planted then fix the others the same, only numbering each ear according to its row. Set the box away in a safe place for future reference. Now make an outline map of each row, or just number them in a book, where you can keep a record of just what you do or of anything you may see that you think might be of importance to you.

Now, as soon as the corn began to tassel, I was needed in the patch every day and detasseled each alternate row, also took the tassel out of every bad stalk, no matter where I found it. I had to be in the patch every day for about ten days, as the tassel should be pulled out as soon as it appears. We detassel to prevent inbreeding or self-fertilization. The male element is in the tassel and the pollen or dust falling on the silk, which is a female organ, fertilizes the germ at the root of the grain, making it possible for the grain to grow. After detasseling is done I watched it closely for any thing of interest I might notice as to the time of ripening, the direction the ears pointed at ripening time, height of both stalk and ears, and made notes in my book. Now, when the corn was well matured, and before frost, I went carefully over each row, and taking the ears, where both stalk and ear pretty well met the requirements, marked it according to its row, and laid it away to dry. All is now done until time to harvest. When that time came I gathered one row at a time, and with the ears from that row from the first selection took the weight of the row, multiplied it by 60, and I had the acreage yield in pounds; so on until all is gathered and stored away. In the last process is where I met my surprises. Row No. 24 was planted from the heaviest ear that I had, and as it came from one of Missouri's best corn growers, and with a strong recommendation, I detasseled that row, thinking to get something extra from it for seed. To my surprise, it made a yield of only 48.3 to the acre, while row 23, just next to it, made a yield of 106.8 per acre—10.5 bushels more than twice the yield.

Now here is a part of the ear (shows part of ear) that was my champion yielder. When I began shelling for row No. 1 the grains looked so fine and deep, set close every way on the cob, which you see is fine form, medium size and cylindrical. The ears had 22 rows, was 9½ inches long by 7.3 inches in circumference. After planting row No. 1 I thought to try one more row from the same ear, so planted row No. 7 from it, and row No. 7 was the best one. Three entire hills in row 1 were taken by a mole, or it would have shown some better; then being the first one was a little against it.

The profitable part of the story is yet to be told. By reference to the accompanying chart, it may be seen that there are several rows making a yield of more than 90 bushels. Now the seed for my entire crop for the coming season will come from the best of those rows, and not an ear will be used that has not come from a yield of more than 90 bushels to the acre, and not an ear bred from a bad stalk.

Now, in view of it all, I think I am entitled to the following dream, the interpretation of which I leave to you:

On an idle day—an hour of reverie—a vision comes before me dressed in robes of emerald and speaks in accents soft and low. "The wild birds' songs echo among the trees; the gentle breeze is laden with the breath of flowers; a carpet of green covers the pastures and the meadows, and I am come to clothe the fields with beauty and to make the nations glad. I shall be kissed by the rays of the shining sun, shall drink refreshing showers and the gentle dew. I shall grow in strength and beauty, be fairer than the flowers, more precious than gems. Then, when age is upon me and these fair garments are faded, within my breast will be treasures of snow and gold that shall gladden the hearts of this hungry world; and when I am covered with a robe of diamonds I shall be kissed to sleep by the rays of the silent moon, and the shining light of the twinkling stars shall keep its tender vigil over me."

CORN BREEDING PLOT—24 BY 54 HILLS.

Row Number	1	Yield per acre	104.4	bushels.
" "	2-x	" "	93.8	"
" "	3	" "	84.8	"
" "	4-x	' "	98.4	"
" "	5	" "	90.9	"
" "	6	" "	68.	"
" "	7-x	" "	114.4	"
" "	8	" "	94.2	"
" "	9	" "	100.6	"
" "	10-x	" "	94.4	"
" "	11	" "	83.2	"
" "	12-x	" "	99.	"
" "	13-x	" "	81.2	"
" "	14	" "	94.	"
" "	15	" "	98.6	"
" "	16-x	" "	70.6	"

Row	Number	17	Yield	per acre	72.8	bushels.
"	"	18	"	"	83.4	"
"	"	19	"	"	91.6	"
"	"	20-x	"	"	78.7	"
"	"	21	"	"	87.2	"
"	"	22-x	"	"	64.5	"
"	"	23	"	"	106.8	"
"	"	24-x	"	"	48.3	"
Average of entire plot					87.6	"

(The rows marked (x) were detasseled.)

THE PRESERVATION OF OUR TILLABLE LANDS.

(Henry Wallace, editor "Wallace's Farmer.")

The subject assigned me is the "Preservation of Our Tillable Lands." I assume that what is meant by this is the preservation or maintenance of the fertility of the tillable land, and I shall so treat it, realizing that no more important question can be raised for the farmers of Missouri or any other corn growing state.

Missouri is a State of wonderful resources, probably second, if indeed at all second, only to the state of Pennsylvania. It has wonderful resources in its vast mineral deposits; in its location, which has developed two great cities, one on each river; but its largest resource is the fertility of its soil. Its forests may be wasted, as the forests of other states have been, but its fertile soil, if given the opportunity, will reproduce them. When its coal or iron or zinc or lead is removed from the earth, there is no further creation. In fact, when we take a broad view of the matter, the farmer is the only creator, the only producer of values. The miner, the manufacturer, the transporter add value to the products of the farm and forest and mine, but do not create value. The raw material of the farmer is the sunshine and the raindrop and the available fertility of the soil. The farm itself is the factory in which he creates each year grains and grasses, and with these produces animal forms that have never been in existence before. Hence the permanent prosperity of the State and of every agricultural state is measured not by its cities or its railroads or its factories, but by the fertility of its soil. If the fertility of the soil is gone, then the prosperity of the State will soon pass away.

I shall not discuss this question from a scientific standpoint. I shall leave Professor Whitney and Professor Hopkins to fight out the questions at issue between them. While they are deciding whether all soils are equally potentially fertile, or whether the fertility of the soil is measured by the amount of available potash and phosphorus I will endeavor to make suggestions which, if followed pending the discussion, will insure the farmer good crops in proportion to the amount of raw material which the Lord furnishes him in the shape of sunshine and shower.

First, if the farmers are to grow good crops in proportion to the raw material furnished them, they must get their land in the best possible physical condition for growing these crops. I am quite well aware that it is not an easy matter to get some Missouri soils into good physical condition. You have in this State a good deal of tenacious clay, which the unregenerate foreigner calls hardpan, and which if it is not hardpan is, to say the least, often a hard proposition. That this hardpan soil is not deficient in the elements of fertility is quite fully demonstrated by this simple historical fact: that after a year of burning drouth you are always sure, with average heat and rainfall, of a first-class crop of every kind within the State of Missouri. You could not grow these crops if the fertility was not there.

Why is the year following a year of severe drouth a productive year in Missouri? Simply because the great heat shrinks the soil particles, pulverizes your clay soils as no plow, harrow or cultivator could pulverize them, and thus permits of the early root growth necessary for a full harvest.

The proper physical condition of the soil is therefore the very first thing that Missouri farmers should consider if they wish to grow crops and also to maintain the fertility of the land. A great deal of Missouri land that is counted poor would be counted rich if it had a first-class dose of good farming.

It is impossible in ordinary years to put land, even if naturally or artificially well drained, in proper physical condition unless it is liberally supplied with humus. Complaints come to me frequently from Missouri that land is worn out or exhausted, and asking what kind of fertilizers to use, when I suspect that all that is lacking is sufficient humus to enable the farmer to put it in proper physical condition. Have you ever noticed how carefully the Great Farmer of all looked after the humus supply in fitting this Mississippi valley for the home of man? He spread a carpet of grass over the prairie and leaves over the forest, growing weeds where grass failed to grow and brush wherever there was an opening in the forest. I cannot believe that in preparing this modern Garden of Eden He intended to allow any one or two generations of farmers to hog in all the fertility and then declare the land worn out, when all that has been done is to exhaust the humus by continuous growing of grain to be sold off the farm.

In order to maintain a supply of humus and thus preserve the available fertility of the soil, it is absolutely necessary on tillable lands to adopt a rotation of crops. You have a good deal of land in Missouri that may fairly be called tillable, and much that is actually under cultivation, that should be given over to permanent pasture. You are strictly in the blue grass country, and in a climate that enables you to utilize the blue grass, under proper management, twelve months in the year. You can also grow great timothy, and could grow clover if your lands were once put in proper physical condition and properly drained.

Under these circumstances why, when the world has never yet had enough fine butter, and when the sheep wears a golden hoof, should you wear out your teams and yourselves in trying to grow corn on this kind of land? If you would go out of your way to kick a sheep, as many Missourians would, or if you don't like to milk cows, repent of your sins against the sheep, and make up your mind to milk cows. We have a good deal of similar land in Southern Iowa, and our farmers are just learning that the road to fortune is not in shocking after the binder, or plowing corn on a short corn row, but in getting their land to grass and combining sheep and dairy farming.

A much larger proportion of your land should be in permanent pasture, and when once in permanent pasture should not be disturbed till your youngest grandchild is of age. Blue grass pasture and good health are alike in this respect, that the farmer never realizes their value until he plows up the one and loses the other.

It is easy for the farmer to adopt a rotation where a rotation is desirable, as it is on land under tillage. The rotation here should be corn harvested and put in shock or in silo; winter wheat drilled in the stubble; clover; manure to be applied on the clover after the first crop is removed, and the second crop with the manure turned under for corn the next year.

The adoption of a rotation necessarily involves some kind of stock farming in order to utilize the clover and other grasses which form so essential a part of the rotation. The Missouri farmer need have no difficulty in determining what kind of stock he should use. The Missouri mule is famous the world over. Cotton and sugar cannot be grown without him. The Boers would have wiped the English off South Africa had it not been for the Missouri mule. The miner cannot do without him, and they all recognize this fact by the large prices they are willing to pay. Hence, if the Missouri farmer is not willing to handle any other kind of live stock, he can at least grow and graze mules, and that, too, with magnificent profit.

The fact that no State has better improved cattle than the State of Missouri, where the farmer has a mind to grow them, is the best of proof that her soil and climate is adapted to this branch of the cattle industry. The fact that sheep farming is so successfully conducted by some men in your State, is sufficient proof of the adaptation of your soil to that proposition.

Growing live stock avails but little, however, unless the owner hauls out the manure as conscientiously as he attends church or votes his party ticket. This will maintain and increase the humus content of the soil, which will enable you to put it in proper physical condition, and enable you to grow crops which will take the place of weeds, which are such a blemish to so many of the fair lands of your State.

If this line of farming is followed, there need be no great fear of any permanent decline in the prosperity of the State of Missouri. I think it possible that some of your lands are deficient in phosphorus, and this is perhaps more particularly true of the non-glaciated districts. Your excellent agricultural college should be able to give you advice on this question that can be followed with safety and with profit. If the line of farming that I have suggested is followed out, I think you will find that, whether there is enough phosphorus in the soil or not, your soil will grow crops in proportion to the raw material furnished you each season in the way of heat and rain.

I wish to warn you, however, against the indiscriminate use of commercial fertilizers, and especially warn you against using them at all without having a sufficient supply of humus in the soil. If you expect to keep on growing corn (or corn cobs in the big corn cob districts) and sell this off the land, or grow wheat and sell it off the land, and do nothing to maintain its physical condition, you will be up against the necessity of purchasing commercial fertilizers. I still further warn you that if you purchase these fertilizers and keep on doing so year after year, you will be up against a worse problem; for commercial fertilizers used without some kind of vegetable matter in connection therewith will put your soil into worse physical condition and make your last state worse than the first. When you have occasion to use commercial fertilizers, let it always be in connection with some kind of vegetable matter.

Do not use any kind of commercial fertilizer unless you have reason to believe, either by chemical analysis or by interrogating your land with crops that will determine its lack of one or other element, that some element is lacking and what particular one. Supply that and save the money that would be spent in supplying elements not needed.

You can grow all the nitrogen you want. If you cannot grow clover you can grow cowpeas, and they are about as good as clover, so far as supplying nitrogen is concerned. Why buy nitrogen, when the air is about four-fifths made up of it, and it, therefore, has no value and cannot be cornered or monopolized?

There may be portions of your State outside of the glaciated district that may be deficient in potash. It may be necessary for you to apply lime to your exhausted soils before they will grow clover, but I doubt if there is any soil in Missouri so far worn out that it will not grow alsike clover, even if it will not grow the common red or the mammoth.

While you are following the suggestions I have made, I advise you to take a live interest in the discussion going on betwixt Professors Hopkins and Whitney. They are both able men, and I am sure both realize the importance of getting the soil in first-class physical condition, and in order to do so keeping up the supply of humus, and in order to do that adopting a rotation of crops, and in order to use the crops, growing live stock. I am sure they will say "amen" when I urge you to haul out the manure every day and put it on grass land, and that they will not file charges against you in the church, even if you should haul out the Sabbath's supply on the Sabbath day. You had better do that than go hunting or to see a game of baseball.

The objection will perhaps be made: How am I to secure this vegetable matter necessary to put my lands in first-class physical condition, and especially on soils that wash badly and show signs of declining fertility? It is usually not possible to readily put lands of this kind in first-class physical condition without humus material, nor is it practicable even for the stock farmer to cover a very great portion of his land with the manure on hand. It must, therefore, not be expected that the best physical condition can be secured at the outset. It will require more labor, and consequently greater expense, to get this kind of land in good physical condition; but, as remarked at the outset, the first thing needed by these lands is a dose of good farming. With thorough plowing and cultivating these lands can be put in much better physical condition, even without additional vegetable matter, than most farmers believe. This will enable them to grow better crops and thus lay the foundation for humus supply. The growth of weeds on these worn-out lands is simply an effort of nature to furnish humus, just as the growing up of the wasted cotton lands of the south in pine timber is one of nature's efforts to supply the waste that has come through poor farming.

The old Latin poet remarked that "Easy is the descent to Avernus" (a polite expression for what the Hebrews call Sheol, the Greeks Hades, and we, in plain English, term hell) ; but to return, there's the rub. It is much easier to maintain fertility than to restore it; but restoration is possible, if the suggestions we have made are followed out both in letter and in spirit.

A student once asked Sir Joshua Reynolds how he mixed his paints, and the old artist replied, 'With brains, sir." It is not possible to maintain or restore the fertility of even good land without a liberal expenditure of the gray matter of the brain, which, after all, is the best fertilizer ever applied to land.

SEED CORN.

(W. E. Johnson, Illinois.)

It can hardly be expected that we are to add very much, materially, to what has already been said upon the seed corn question. While it is true that after we have obtained a good variety of corn and secured a sufficient amount for the next year's planting, the one thing needful is to preserve the same in good condition until the time of seeding. I am aware of the fact that should I lay down any specific rule to be observed, that I at once invite criticism from those who are many years in advance of myself in this work; yet, however fair that criticism, it does not follow that the manner and methods used by the seed corn growers are fully adapted to the farmer's wants in general: 1st, because of the extra cost of building a house in which to store the seed corn to prevent it from being injured by freezing; and, 2nd, because the farmer, having more work than he can generally perform well, cannot give the work the attention that should, from the nature of the case, be given to it. I presume that if I were to ask a number of men how they handle their seed, possibly no two would give the same answer.

Notwithstanding what has been said in the bulletins and through the newspapers as to the best methods of preserving seed corn, you will find many claiming to have fully solved the proposition. One man will tell you that he and his grandfather before him have always gathered the corn in the early fall and hung across wires until thoroughly dry, in fact, will let it hang until spring, when meat-smoking time comes on and it is given a good smoking, which insures a sure stand and prevents worms and insects from infecting it. Others will tell you that they do not need to go to the trouble and expense of caring for it through the winter; that they can go into the crib in the spring and select a corn that will grow, little realizing what damaging effect the changeable conditions of the atmosphere may have had during the winter season, the corn never having become thoroughly dried.

Now, we should not only be satisfied that the corn will grow, but that it will also make a strong and vigorous plant.

The fact that our lands have doubled in value in recent years, and that our yields have not been commensurate with the same, should appeal at once to the farmer to embrace every opportunity to enhance the value of his corn crop, and the care of the seed corn is one of no small importance. Almost every farmer has some closet or room where the seed can be placed during the winter, where it will have plenty of air and heat, and be free from the ravages of mice. In case this can not be done, it would be well to arrange a frame or crate, large enough to hold the season's planting, and by means of wires it can be hung to the rafters or ceiling of the barn or granary. The seed should be conveyed to the crate as soon as selected from the field, as delay at this time might prove disastrous to the corn; and especially so if there should be two or three wagon loads of rats and mice harboring about the place, as new corn acts as a sort of breakfast food to these rodents and whets their appetites for more seed corn.

Due attention given to the seed in some such manner as described will assist us very much in overcoming some of the difficulties encountered in the spring time in securing a good stand, which is one of the chief sources of obtaining a bountiful yield, the analysis of which is selection, preservation and cultivation.

FIELD TREATMENT OF THE CORN CROP.

(P. E. Crabtree, of Hannon, Mo.)

Mr. Chairman, Ladies and Gentlemen: There can be no strictly first-class specimen produced, in either plant or animal life, without taking into account the three following considerations: Feeding, breeding, individuality.

Field treatment of the corn crop has to do with the feeding of the plant, inasmuch as the whole process up to the time of the maturing of the crop is simply a series of operations which enable the latent force that lies within the seed grain to undergo its development in extracting from the soil and the air the necessary plant foods at its command.

Two things are necessary to enable the plant to perform its function of development, viz., that the mineral plant foods be present in the soil, and that the soil also contain enough humus or decomposed organic matter to absorb enough moisture to hold the plant food in soluble form to be taken up by the fine rootlets of the plant. Also a soil devoid of humus would contain little, if any, nitrogen.

The field treatment of the crop must then necessarily include the having present in the soil of the three exhaustible plant foods marked in the commercial fertilizer catalogs: "nitrogen," "phosphoric acid," "potash" and the necessary amount of water to hold them in solution.

How is this to be accomplished? A virgin soil usually contains the plant foods and the humus. In continuous cropping they must be retained or replenished. Returning the farm manures to the fields *retains* them largely, and keeps up the supply of humus very well.

Applications of commercial fertilizer replace in the soil the plant foods without any appreciable amount of humus, and in case humus is badly deficient, the conditions of moisture are so uneven as to make the results far short of what could be secured under ideal conditions of the soil.

A double purpose is served in plowing under of a leguminous crop, thus securing much humus, and, with the same, capturing large quantities of free nitrogen from the air, which is thus incorporated into the soil as available plant food.

The moisture problem is, within itself, a very great one. Seldom do we find a field where the soil is continuously too dry. At times the amount of moisture present is far in excess of that required, and this fact makes its absence severely felt when such a climax ensues.

On slightly rolling land, with a pervious subsoil, the proper moisture conditions are readily secured. On flat land, with pervious subsoil, tile drainage takes care of the surplus water. On flat land, with an *impervious* subsoil, tile drainage is a failure, and we resort to surface grading of the land by back furrowing the field some three or four years into loaves or elevations, some eighty feet wide, and thus the excessive water is quickly carried off through the depressions of the field to the outlet or escape.

My attention was first called to the great benefits secured by surface grading some years ago while traveling through Northern and Eastern England, and I have ever since practiced it with the most satisfactory results.

During the process of surface grading the field, attention must be given to supplying humus and plant food to the depressions from which the original surface is being removed, in order to maintain a uniform degree of fertility. This is best accomplished by the use of the manure spreader.

When the desired grades are once established, the surface can be plowed down and up, alternately, and the drainage remains thorough and permanent and is no inconvenience.

Aside from its other functions, the annual plowing of the field serves to establish a cushion for the rapid absorption of falling rain, and this is very essential during the growing season of the corn crop, and more especially when the showers are light and far between. At such times no moisture should be allowed to escape in the form of running water. With the surface grading and correct annual plowing, the ideal conditions of moisture (enough and not too much) are most nearly secured.

Steep rolling land with an impervious subsoil makes a poor field for corn, for the reason that the surface soil washes away badly, and also that there is no reserve moisture to be returned to the plant through the process of capillary action, and this is subject to injury from drought. Such land should be used for pasture purposes, and something better utilized as a corn field.

PREPARATION OF THE SOIL.

The ground should be plowed as long before planting as is reasonably possible, to permit the bottom of the cushion of plowed earth to again become compacted and firmed to the subsoil, that capillary action again be established at that point. Fall plowing is preferable in my locality.

When the breath of spring begins to awaken the slumbering germs of the weed seeds a good double harrowing is desirable, that the surface of the ground be made smooth and thus hurry the germination of those weeds that are to become one of the next considerations.

A few warm days and a shower following such harrowing will start nearly all of the seeds near the surface, and it then becomes a very easy matter to annihilate them before the corn is planted.

When the larger ones are a half inch in height the field should be double-disced, and after which, as soon as the surface shows a sufficient drying condition to lighten its color, a double harrowing (with spike-tooth harrow) will almost eliminate the consideration of weeds from the field for the present season, with the exception of the cockle-burs and morning glories. Crabgrass will come later, however.

This double harrowing should be at an angle across the field (some fifty degrees), and a subsequent single stroke of the harrow, driven the direction across the field that the rows are to run, prepares an ideal seed bed, and we are ready for the planter.

PLANTING.

I prefer checking to drilling, although I drill a small piece in a new orchard every year. Thicker planting can be indulged in while checking, without its evil effects, for the reason that the sunlight and air reaches the soil and the plants better.

A uniform depth can approximately be maintained in the covering of the seed grains on soil prepared as above, and my choice depth for average planting is 2¼ inches, varying to shallower, when the ground is cold and damp, and to deeper when the ground is warm and dry.

Thickness of stand will depend on the part of the state and the type of corn grown, and in my section (southwestern section) the heaviest yield is secured by planting two grains to the hill, checked 40 by 42 inches.

Accurate, uniform dropping is essential, and the only way I know to secure that is by using seed of uniform grain in an edge-drop planter.

CULTIVATION.

Between the two systems of cultivation, "deep" and "shallow," I greatly prefer the latter in the main. Severe root pruning I think very detrimental to the corn plant at any stage of its growth. However, I have carried out experiments that show one that slight root pruning at the *proper time* is beneficial. I fully understand that there are those whose teachings indicate that they do not agree with me here.

Any one who will test it on a plot, uniform in fertility and moisture, will find by subduing the weeds and grass alone with the hoe and not root-pruning, even slightly, that the stalks will run up very high, will be longer in joint, narrower in leaf, ear higher set on stalk in proportion, and produce much stalk and little ear. On other parts of the plot let them treat it respectively, as follows: In addition to subduing weeds and preserving much otherwise; one cultivation, two cultivations, three cultivations, four cultivations. Let none of the cultivations be deep enough to make root pruning very severe, and note the results. I have described the first.

The fifth condition will give a large ear and small stalk by height and weight, although the stalk will be heavy at the base, ear well set, broad leaf. The fourth condition will give large ear, larger stalk, long and medium broad leafage. The third and second conditions give results plainly a compromise between the extremes according to the degree of their root pruning, from which I deduct and practice the following plan:

I use a six-shovel cultivator, place bull tongues next the row the first time, cultivate very young, set the bull tongues quite deep and the other shovels shallow. Cultivate close. The second time use the shovels all round, set shallow next the row and avoid approaching the plant too closely. This does some root pruning, but is not severe, as also do the third and fourth cultivations.

The slight root pruning at second, third and fourth cultivations appear to slightly check the plant food in the soil into fodder or stalk at a time that, owing to the age of the corn plant, it cannot convert it into the fruit or ear.

Apparently, if checked as mentioned, it is in immediate reserve and is utilized by the plant in the production of the ear immediately following, and also serves another purpose in shortening the stalk and thus admitting of a thicker planting. I accomplish, as nearly as possible, level cultivation until the last or fourth, when I place a pair of warped shovels next the row, thus throwing a very narrow little ridge in the row to encourage the brace-roots in hurrying out their net work of little rootlets to assist in accumulating *soil of fertility* at the time when it is utilized in the production of a large healthy shoot and the proper development thereof.

SEED PLOT.

As in years gone by, I still find it profitable to cut down the occasional barren stalk, although I have the tendency pretty well bred out. Extra thick planting on a rich soil will produce many barren stalks with the best of seed. This, of course, is done before the tassel has developed, and at the same time are detasseled all undesirable stalks standing on the seed plot, whether it be a defect in root system, leafage, long joint or set of ear on stalk. Emasculation takes place with all stalks on the seed plot except those which are capable of being used as desirable sires, and thus when husking time comes it is surely known that every ear coming from a stalk that was left entire comes from a most desirable parentage on both sides.

This, together with selection for a good sized, thick, uniform grain, with extremely large, full, bright germ, and the elimination of all the excessive crown starch beyond what is necessary for the maintenance of a beautiful crown dent, is responsible for what I have been able to accomplish in the way of *producing capacity.*

HARVESTING.

There is not much to be said regarding the harvesting of corn for commercial purposes, further than that it is, of course, essential that it be done when the crop is in good marketable condition and that it be thoroughly cured before being assembled together in large quantities.

In the production of corn for its stover, however, there are many ways of handling, and perhaps the siloing of it is the best. With all that, nicely cured and properly fed, dry corn fodder is much relished by many kinds of stock, and I use it for both cattle and horses.

Long ago I determined that it did not pay me to produce merchantable corn and my choice corn fodder on the same ground at the same time, or even to continue to attempt to do so. I prepare my fodder field as the other corn fields are prepared, and wait until about June 10th to plant. I plant four grains per hill, hills 40x42 inches, and the results are practically ideal.

The corn cutting comes after all the early, warm fall rains, that so seriously damage early planted fodder, are over. It is shocked the last few days before frost in ideal condition, as our first killing frost in my part of the State is pretty uniformly near October 11th.

Prepared in this manner many of the stalks are barren, and thus their entire substance is contained in the form of roughage. Others have medium-sized ears to the extent of furnishing just the right amount of corn ration to accompany the fodder. All that remains necessary then to secure a perfectly balanced ration for the stock is to feed the horses once a day a ration of wheat bran and oil meal, or clover, alfalfa or cowpea hay, while with the cattle it is the same, except that cottonseed meal is used instead of oil meal.

Fodder, made as I have suggested, is consumed almost entirely, and it yields immensely when planted in this way, and consequently but a comparatively few acres are required to be devoted to the production of the fodder.

Of the various methods of harvesting, after considering cost, speed and condition of the fodder, I greatly prefer the three-wheel, two-row cutter, drawn by one horse and operated by two men.

In the feeding of the fodder no attempt whatever is made to husk or otherwise remove the ears. It is fed entire by placing on a farmer's handy-wagon once a day a sufficient amount for one feeding, which is scattered over the various parts of pasture lands, and thus what little of stalk is left is distributed on the thinner portions of the field in the one operation of feeding, as well as accomplishing the distribution of the droppings of the animals so fed, and thus much farm labor is saved, which has really become one of the vital considerations on all farms.

To those who have never fed corn fodder other than the ripened fodder from completely matured corn, and which has in almost all instances become seriously damaged, I can say, in all truthfulness, that there is a genuine surprise for them in the amount of food per acre that can be produced when planted for corn fodder, nor is the small amount of work connected with its feeding in this manner any more generally understood.

Finally, I might add that I find it pays me well to remove the tillers or "suckers" from the fields that are calculated to produce a merchantable article of corn. My soil is not naturally a very rich one, and where I use not to exceed one hundred pounds of commercial fertilizer per acre, the suckers need be removed but once, which I have done when they are some five inches in height, the corn being then about knee high. Where some one hundred and fifty pounds of the fertilizer have been used, it is necessary to again remove them.

This second campaign against them is waged when the second crop of suckers are about knee high and the corn about shoulder high.

Under the conditions named there are about sixty per cent as many suckers to remove the second time as there were the first time. The cost of removing them is approximately fifteen cents per acre per time, and the increase in yield is several bushels per acre, from the fact that did I not have them removed I must necessarily plant considerable thinner on the ground, or suffer the ill effects of having too thick a stand after the suckers had developed.

Although there are other items worthy our consideration, we will at this time let this suffice on the "Field Treatment of the Corn Crop."

METHODS AND DIFFICULTIES OF CORN BREEDING.

(C. P. Hartley, In Charge of Corn Investigation, U. S. Department of Agriculture)

At this stage of advancement in corn breeding work it is hardly necessary for one to speak to an audience of this kind regarding the advisability of improving strains of corn. Most of us have witnessed a number of times the great advantage derived from the planting of improved strains. We have passed the degree where it is necessary to argue the advisability of breeding more productive and more uniform strains of corn for different sections of our country. We know it is our privilege and our duty to produce these strains, and are face to face with the question as to the best, simplest and quickest means of obtaining the results.

Plant breeders have rapidly reached the ground now held by animal breeders and know that our advancement depends upon our ability to find desirable individuals that will transmit to a high degree desirable characters. As the most valuable point in connection with corn improvement is the increasing of the production per acre, we can see that the principal point in connection with this work is the finding of individual ears of high producing power. There are other points that can at the same time be kept in mind, such as the improvement in appearance and fixing of the type, but even these are easily accomplished and of minor importance in comparison with the leading point just mentioned. The fixing of a type of corn is comparatively an easy matter. The production of a highly productive and well acclimated strain is more difficult. Fortunately, the two can be accomplished at the same time, but whenever it comes to a choice between a typical ear and ear of great producing capacity, the latter should always be chosen.

Various schemes and systems in regard to the order in which the pedigree ears are planted in the breeding plat can be devised, and many of them are very good methods. Some are too complex except for experienced experimenters to undertake, and the reasons for the need of such complexity are in some cases founded on theories that have not yet been demonstrated.

As many of the strains for the different sections of the United States must necessarily be produced by corn growers who are to a greater or less degree engaged in general farm work, it becomes necessary for us to simplify our methods to the greatest extent possible to the accomplishment of desired results. It is one thing to plan on paper a method of procedure, and quite another thing, especially if the method be complex, to put it into practice, especially in connection with general farm work. A vast number of conditions, circumstances and causes are to be taken into consideration, so that we can not say that we have reduced corn breeding to an exact science. An architect, knowing the size of a proposed building, can estimate the number and size of the stone to be used, etc., and know that the building can be erected exactly in accordance with his figuring. We have not reduced corn breeding in all its phases to such a complete mathematical exactness. It will be many years before this is accomplished, if, indeed, it ever is. In the meantime, we can and should greatly improve our different types of corn by putting into execution in different parts of Missouri such methods as have been demonstrated to be productive of good results.

In connection with the corn improvement work of the Department of Agriculture, in co-operation with various corn growers, we have tested several different methods of corn breeding, and in several cases it has been a choice between the simplification of the methods or a partial failure in carrying out the plan successfully. By some of these methods, which are not too complex for the average careful corn grower to practice, we have increased the production per acre at the average rate of 24 per cent each year for the four years the breeding work has been in progress. On the present occasion it will be much more valuable for us to consider the objects to be accomplished and the best means to those ends, rather than consider any fixed and inflexible method of procedure. The details in connection with the work must to some extent be worked out to conform with the circumstances and possibilities of the farm.

As the breeder of dairy cows is seeking for the individual of great butter producing capacity, so the corn breeder must seek the individual ear having great power of producing grain. If this power to produce could be determined by inspection, the work would be greatly simplified, and a person possessing the power to select by inspection ears of high production could command a high salary.

Of two ears exactly alike in appearance one may have the power of producing twice as much as the other, and it is for the corn breeder to put these ears to the test that he may be able to select seed from the most productive. In order that the test of the producing power of select ears may prove true and valuable, it is necessary that the ears be equally well preserved, for on the care and preservation of seed corn depends largely its power to produce. If some ears have been better cared for than others, the test, when completed will not decide the inherited tendencies of the ears toward great production.

In many sections of the East, where the fields are much broken with ravines and clay banks, it is next to impossible to make a valuable comparative test of the producing power of individual ears. In Missouri and other States of the Mississippi Valley, where large tracts of quite uniform soil exist, the task is much easier, but even here very close attention must be given or the results will not be valuable. Not only the uniformity of fertility, but the topography of the land must be considered. If some rows are on much lower land than others, the comparison of the producing power of the ears will be destroyed. If it becomes necessary to plant on a piece of ground, one side of which is more elevated or more fertile than the other, it is necessary to run the rows in such a direction that each row will occupy equal portions of the low or fertile land. I wish to place great stress upon this point, namely, that the rows be given equal chances in all respects, because otherwise the records of production do not indicate the inherited tendencies of the ears to produce, but rather indicate the fertility of the situation the particular ears occupied in the plat. As there is always a possibility that some of the rows may occupy positions more favorable to growth than other rows, a duplicate planting is recommended. In this way seed from each ear is planted in two different rows located in different parts of the field, making it very much more likely that the seed from each ear has, as an average, equal chances.

The method of plowing might be overlooked and considered to have no influence upon the yield of the individual ears, but I have experienced the harvesting of breeding plats in which the central rows of the plat produced very much more than the adjoining rows and which could be attributed solely to the fact that the central rows were located upon what are termed back furrows or the line where the two furrows were thrown together in starting the land. In weighing the yields from such rows, it at first appears as though these central rows are very desirable ones from which to save seed, but when it is known that their greater production is due to location rather than to the ability of the seed ears to produce, we can understand how the selection of seed from such rows would fail to produce the results. In other words, it is our desire to save seed from the progeny of individuals that produce well because of their inherited tendency to do so, rather than because conditions have been favorable for good production. In this connection I wish also to state that it has been my privilege during the past fall to examine a field, strips of which were plowed with two different kinds of breaking plows, and at harvest time it was very evident that the strips broken with one plow had produced, without exaggeration, fully twice as much corn as the strips broken with the other plow. This serves to illustrate the great need of uniformity in connection with all our work on a plat to be used for corn breeding purposes.

We occasionally find a man who has made a feeble attempt at breeding corn who, failing to have the seed ears uniformly preserved, and all other conditions uniform, has failed to demonstrate that seed from the most productive rows will produce best, and is ready to discredit the ear-to-row method of breeding. He can as correctly assert that it is immaterial whether we use, for breeding purposes, the best or the poorest cows in a dairy herd. We can rest assured that nature will do her part if we but do our part correctly.

If accurately performed, great differences regarding production and appearances of the rows will appear. In many breeding plats this difference frequently amounts to 60 or 80 per cent—that is, one row will produce 60 or 80 per cent more corn than the adjoining row. Differences in appearance between the rows are very striking and are hardly credible to one who has not seen breeding plats planted in this way. Figure 1 shows the appearance of two adjoining rows in one of our breeding plats as photographed in October, 1906.

It often happens that the most productive rows stand adjacent to rows of poor production. In such cases the detasseled portion of the good row has naturally been pollenated mostly with pollen from the poor rows adjacent. This is a very undesirable state of affairs, since both parents have equal influence in determining the characters of the progeny. This state of affairs can be overcome by testing the producing power of the ears the first year by planting about one-half the seed from each ear. The next year the remaining seed from only those ears that produced best can be planted in a small plat. We will then know that all the stalks in this small plat are the progeny of high yielding ears.

The production of suckers or tillers is very objectionable, since the suckers sap the ground to about the same extent as the main stalks, and very rarely produce good ears. Our experiments have demonstrated that the tendency to produce suckers is strongly inherited and that this tendency can be overcome by breeding. In carrying out experiments to determine this point, hand-pollenated ears were produced in large numbers, records kept giving characters of both parents, and all necessary precaution taken that the test should show the influence of the two parents in regard to formation of suckers. The results are tabulated on page 144 of Vol. II of the American Breeders' Association. The progeny of both male and female parents that possessed no suckers gave an average of two and one-half per cent of suckers, while the progeny of the parents that possessed suckers gave an average of fourteen and one-half per cent of suckers.

To produce a strain that will not sucker it is necessary to take seed each year from stalks that do not produce suckers, and in order that we may do this, it is advisable that breeding plats be planted with one kernel in a place. If planted in hills it is practically impossible at harvest time to distinguish in some cases between suckers and main stalks. Furthermore, by planting one kernel in a place it gives each stalk a better opportunity to demonstrate its power of production. As it has also been shown that this tendency to produce suckers is affected by the source from which the pollen comes, it is advisable not only to detassel suckers, but to detassel all stalks that produce a large number of suckers.

This brings us to the question of detasseling. It is not to be understood that detasseling is absolutely necessary in connection with corn improvement work. Very great improvement can be produced without any detasseling. But since it has been conclusively demonstrated that very injurious results follow self-fertilization in corn, and since we know that under natural conditions some self-fertilization takes place in a corn field, it is evident that some injurious effects can be obviated by the detasseling of the stalks from which seed is to be taken. As our energies are exerted toward the determining of the ears of greatest producing power, which can not be decided upon until harvest time, it is advisable that half of the progeny of each ear be detasseled. If alternating rows be detasseled, as advocated by some breeders, it may and often does happen that some of the most productive rows are not detasseled. Very satisfactory results follow the detasseling of half of each row, alternating, so that the north half of one row will be detasseled and the south half of the adjoining row. If performed in this way, not enough tassels are removed to interfere with proper fertilization of the silks.

In weighing the past fall the yields from the rows of some of our breeding plats it was determined that injurious results had followed detasseling in certain instances, but this was attributable to the fact that too much of the top of the stalk was cut off in the process. Tests in regard to this point made in other breeding plats show that no injurious effects follow the detasseling when properly performed. The best method of detasseling is the pulling of the tassels soon after they appear. If taken at the right time the tassels unjoint readily and can be easily pulled. To accomplish desired results the tassels must be removed before they discharge any pollen. The cutting off of the top of the stalk, especially if some of the blades be cut off, is injurious and should not be practiced.

Next in importance after uniform treatment of seed ears, uniformity of soil conditions, and uniformity in plowing, planting, cultivating, etc., comes the question of uniformity of stand of stalks. Comparative powers of production can not be determined unless the stand of stalks is comparatively uniform. Tests conducted by many experiment stations demonstrate the great influences exerted by distance of planting. Absolutely uniform stands are next to impossible, and I have no toleration for experiments that are calculated to a uniform stand, when in reality many of the rows contain one-fourth to one-half more stalks than others. These calculations are very misleading. If a row having three-fourths of a stand produces 300 pounds of corn, we can not correctly assume that this row would have produced 400 pounds had there been a full stand. If the stand is too thick it is not fair to assume that the production would have been one-fourth less had the number of stalks been one-fourth less. Neither is it fair to assume that because the rows have been thinned in the spring to a stand of three stalks per hill, or one stalk every 18 inches, that the stands are even in the fall. Actual counts of the stalks per row must be made at harvest time, and all rows that do not approach very closely to a perfect stand should be thrown out of the test.

Because of poor germination, and because of the exhibition of very undesirable characters, some of the rows of the breeding plats can be thrown out of the test without spending upon them any time in counting or selecting seed. If these undesirable characters can be ascertained before the shedding of pollen, such rows can be detasseled, and thus obviate the injurious effects that are sure to follow where the stalks of such rows are allowed to shed their pollen in the breeding plats.

From all the rows except those that are plainly inferior and can be discarded without further work, seed should be selected from the detasseled portion. To be sure, for the planting of the breeding plat next year seed will be wanted only from the most productive rows, perhaps the most productive eight or ten rows of the plat. But since the most productive can not be determined until after the crop is harvested and weighed, it becomes necessary to select from the standing stalks the best seed from the detasseled portion of every row that can not be thrown out by inspection. It is often convenient to place this seed at the time it is selected in bags, but unless it can be removed the same day it is gathered to a place where it can dry readily, and the seed from the different rows kept separately, it should not be bagged, as injury is apt to result if left enclosed in bags for even a few days. Crates, and especially folding crates, are very convenient and satisfactory for this work. Half-bushel and bushel folding crates can be obtained from the Cummer Manufacturing Company of Cadillac, Michigan.

In selecting the desirable ears from the various rows of the breeding plat, the stalk characters should be kept uppermost in mind, and preference should always be given to stalks that produce well under adverse conditions, rather than to those that are best located. If one end of the rows is on poorer soil than the other, any good ears that are found upon the poor land are to be preferred to ears equally as good but produced on fertile land, and good ears produced on stalks that have had to compete with closely surrounding stalks are to be preferred to equally good ears produced by stalks having an unusual amount of space. One should take no seed from stalks that are tall or slender, bear their ears too high from the ground, have suckers, smut, or are easily broken. The breaking down or lodging of the stalks is a character that can be examined comparatively only where corn is planted in breeding plats as described. In such plats late in the fall rows are often found of which 90 per cent of the stalks have broken, while adjoining rows may have as few as 10 per cent broken. This is of much importance, as the quality of the corn at harvest time depends so greatly upon the ability of the stalks to stand erect and keep the corn off the ground and dry.

One feature of corn breeding work which may not occur to breeders until they have suffered a loss is that it is each year best to save double the amount of seed that is needed for the next year. As one can not control all the conditions, it often happens that floods or hail storms completely destroy the plats, and unless care is taken to reserve seed, the entire labors of past years may be lost. In this connection it is in place to state that corn breeding work is a never-ending work, a work that must be continued from year to year. If one is successful in producing a new orange, such as the navel orange, or an improved grape or apple, he can rest knowing that it will continue for years, but the improvement on a strain of corn may be lost in one year's time. The good results accomplished, such as increased production, will not disappear completely in that length of time, but if the strain is allowed to mix with undesirable strains of corn the work of past years is ruined.

One contemplating the breeding of corn must for safety count upon some of his neighbors planting other kinds of corn just where he would not have them planted, and even though he may have the best corn in the section, and offer free of charge the seed to his neighbors in order to prevent troublesome admixtures, there are always neighbors who are of the opinion that from a distant State they can obtain a better corn, and are desirous of demonstrating their opinion by planting such a corn in a field adjacent to their neighbor's breeding plat.

It is the tendency of the corn plant, in common with other plants, to adapt itself to its environment that makes it necessary that corn breeding work be done in various sections, and it is this same fact that makes it highly advisable that some of you be the first to begin the improvement of a strain of corn for your section. One of the principal inducements we have is the fact that the best corns now in existence are those that have received greatest attention for the greatest length of time in the section for which they are now so admirably adapted. Let no corn grower plant ordinary seed, doing so with the belief that it is too much trouble to produce good seed. In fact, it is too much trouble to plant any but the very best of seed corn. It is too much trouble to plow, harrow, plant and cultivate two acres in order to obtain eighty bushels of corn, when with better seed that amount can be grown on one acre. Plant only the best of seed. If you do not care to produce your seed, then buy the very best. Unfortunately, in many sections of the country at present the only way to get seed of best quality is to breed it. It is an opportunity for you to begin a profitable industry, as well as an opportunity to become of immense value to all the corn growers of your neighborhood.

Do not hesitate to begin corn improvement because you fear you can not follow all the methods recommended by corn breeders. Begin with a simple method, and you will become interested and gradually improve your method. The best strains that exist were produced and brought to a high degree of improvement by very simple methods. By improved methods they are now being more greatly improved.

One of the chief and uncontrollable difficulties in corn breeding is the changeableness of the seasons in many sections of the country. If the seasons remained the same, we could in the course of a series of years produce a corn suited to these conditions, but the good effects of years of selection in a section usually dry may be greatly reduced by a few seasons of wet weather. However, these are conditions that are completely beyond our control, and we must make the best of the opportunity. We can increase the ability of certain strains to stand dry weather by breeding them for a series of years in climates that are constantly dry, and the Department is beginning work with this object in view, with the hopes that sources from which well bred seed of highly drought-resisting strains can be obtained may prove of value to corn growers of the semi-arid sections. Some native strains now found in very dry sections possess drought-resistance to a high degree, but they are usually low yielders, or possess undesirable characters, or require too long a growing season to admit of their utilization in the semi-arid sections of the United States. We hope to improve and acclimate some of the best of them.

Most of the difficulties that have come up in connection with corn breeding work have been brought to your attention, not for the purpose of discouraging any one taking up this work—far from it, but for the reason that those contemplating this line of work may see the difficulties before them, that after once undertaking it they may push forward with a determination to overcome all obstacles and be successful in producing the very best corn for their locailty.

It is hoped that before many more years have passed that we shall have a hundred or more careful, honest corn breeders in every State, each a member of his State Corn Breeders' Association and of the American Breeders' Association. The corn breeders' association of every State should prepare a brief description of the strains of corn recognized by their association, together with the addresses of the breeders of each strain. A copy of these descriptions and addresses should be furnished the Committee on Breeding Corn of the American Breeders' Association for publication in its annual report. This would give us a complete directory of the established strains of corn of the United States, and sources from which seed may be obtained and a national organization for the improvement of corn. With an active organization of this kind, the production of corn within your State and within the United States would not long remain below thirty bushels per acre.

SOME EXPERIMENTS WITH FERTILIZERS ON CORN IN MISSOURI IN 1906.

(H. A. Huston, Illinois.)

The principles regarding soil fertility and the desirability of supplementing manures and leguminous crops with additional plant food have been set forth so fully in the addresses of the distinguished experimenters from other States, who have presented the results of their investigations to you at this meeting, that it only remains for me to bring before you the results of some experiments conducted in Missouri, by farmers, under ordinary farm conditions. These are, of course, less elaborate than the work of the experiment stations, but they may, perhaps, be none the less interesting to you, because they are intended to connect directly with the ordinary farm operations and to supplement the materials already in common use.

The experiments mentioned below use, as a starting point, the fertilizers already in common use in the State, and illustrate what can be done when a partial fertilizer like bone receives an addition required to make it into a *well balanced* "complete" fertilizer, or when a badly balanced "complete" fertilizer receives an addition to make it better balanced. It will be noticed that nitrogen in the form of blood, and in some cases bone also, is used. It is a matter of common observation in the Central West that the experiments on corn show practically no gain from nitrogen in commercial forms. Yet in these experiments it was used in order that the full effect of the mineral fertilizers might not be reduced by the lack of nitrogen. In farm practice, nitrogen for corn must, of course, be derived from manure and leguminous crops. The corn plant uses nitrogen from these coarse materials with great facility.

Last year we considered an experiment at Raymondville, Mo., by Mr. Geo. C. Martin, on a very poor type of soil. This year Mr.

Martin repeated the experiment on some of the most productive soil of that section with the following results:

EXPERIMENTS AT RAYMONDVILLE, MO.

	Fertilizer per acre.	Yield per acre, bushels.	Increase due to Fertilizer, bushels.
Plat 1	None	38.3	
Plat 2	Blood, 168 lbs. Bone, 300 lbs.	43.9	5.6
Plat 3	Blood, 168 lbs. Bone, 300 lbs. Sulphate of potash, 120 lbs.	62.4	24.1

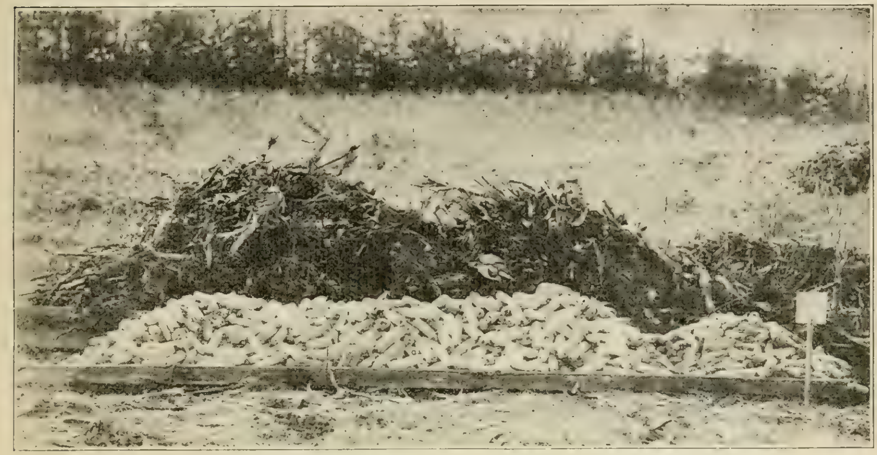
EXPERIMENT AT RAYMONDVILLE, MO.

Plat 1. No fertilizer. Yield 38.3 bushels per acre.

Good corn. Poor corn

EXPERIMENT AT RAYMONDVILLE, MO.

Plat 2. Fertilized with 300 lbs. bone and 168 lbs. blood per acre. Yield, 43.9 bushels per acre.



Good corn. Poor corn.

EXPERIMENT AT RAYMONDVILLE, MO.

Plat 3. Fertilized with 300 lbs. bone, 168 lbs. blood and 120 lbs. sulphate of potash per acre Yield, 62.4 bushels per acre'

Good corn. Poor corn.

The results are quite similar to those of last season. The expenditure of $3.00 for the potash on plat 3 resulted in a gain of 18½ bushels of corn over the yield on plat 2.

At Ashland, Boone county, Mo., J. R. Martin had been using a fertilizer containing 1.6 per cent of nitrogen, 8 per cent available phosphoric acid and 2 per cent potash, one of the most common brands of "complete" fertilizer on the market, at the rate of 200 pounds per acre. This was supplemented with 50 pounds sulphate of potash per acre, with the following results:

EXPERIMENT AT ASHLAND, MO.

	Fertilizer per acre.	Yield per acre, bushels.	Increase due to fertilizer, bushels.
Plat 1	None	54.6	
Plat 2	200 lbs. 1.6-8-2	59.7	5.1
Plat 3	200 lbs. 1.6-8-2 and 50 lbs. sulphate of potash	70.3	15.7

Here the addition of 50 pounds sulphate of potash, costing $1.25, gave an increase of 10.6 bushels of corn.

At Troy, Mo., Mr. H. H. Twellman conducted an experiment in which the corn was graded and the stover was weighed, and obtained some very interesting results.

EXPERIMENT AT TROY, MO.

	Fertilizer per acre.	Sound corn, bu.	Increase due to fertilizer.	Nubbins.	Stover, lbs.	Increase.
Plat 1	None	22.2		11.6	4,140	
Plat 2	Blood, 100 lbs. Acid phosphate, 300 lbs.	32.1	9.9	10.7	5,590	1.450
Plat 3	Blood, 100 lbs. Acid phosphate, 300 lbs. sulfate potash, 100 lbs.	49.3	27.1	3.6	5,800	1,660

This experiment illustrates very clearly a fact known to experimenters, but often overlooked—that when there is a lack of plant food the vegetative part of the plant uses it at the expense of the grain. A comparison of plat 2 with plat 3 shows that the balancing of the fertilizer produced an increase of 17.2 bushels of sound corn with an increase of only 210 pounds of stalks. The corn grower is interested in producing corn rather than stalks.

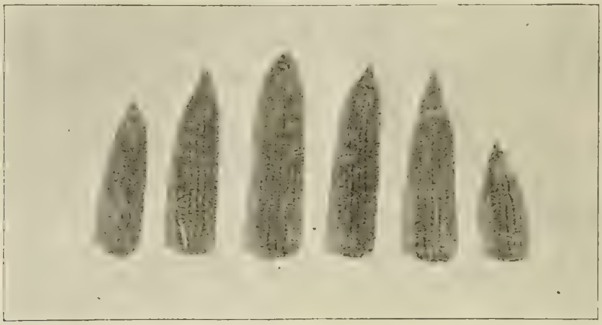
Your President in his address urges you to select, breed and show corn. The live stock men said to feed corn. But if you will feed the corn plant right you will have more and better corn to feed to the live stock. Moreover, the breeder of seed corn should pay attention to feeding the plants. For in one season proper feeding of the plants will produce more difference in the amount and configuration of the product than many years of selection alone.

Many corn breeders believe that manure and clover are all that is necessary to produce the best seed corn, and in most of the discussions and addresses about improving corn little or no attention is given to the matter of providing the right kind of plant food in available form. It is on this account that buyers of well bred seed corn often fail to get the expected returns. The cuts will illustrate this better than any argument or long description.

The corn was planted on the same day, from the same seed, in the same field and received the same cultivation. The pictures were taken on the same day, and the points photographed are not over 200 feet apart. The repeated application of manure and clover has put the soil of the field in excellent mechanical condition, and the repeated application of the bone has more than maintained the supply of phosphoric acid.

Showing the part of corn field which has received repeated applications of manure, clover and bone. Note short weak stocks and nearness of ears to the ground.

The land with the short stocks and badly filled ears has received all the things that most corn raisers think necessary for raising



Characteristic ears from field which received repeated applications of manure, clover and bone The tops of the ears are all chaffy from lack of starch.

Showing the part of corn field which has received the same application of manure, clover and bone as the part shown in previous picture and one application of muriate of potash. Stalks and ears of normal size.

good corn, and an ample supply of phosphoric acid beside. Yet it will not produce satisfactory corn.

The land raising the normal corn has received the same treatment, and a moderate amount of potash in addition.

The experiment illustrates very forcibly the fact that for the formation of starch *available* potash is required.

The land has been badly worn, like lots of Missouri clay loams, but has been brought back to a fine mechanical condition again by the coarse manures and clover. It contains a large amount of *total* potash, so much that an analysis would indicate that it was "inexhaustible." It is really "inexhaustible," not because there is so much of it, but because it is so unavailable, and three rotations with manure and clover in each has not apparently increased its availability.

Characteristic ears from field that received repeated applications of manure, clover and bone and one application of muriate of potash. Note that there has been enough starch formed to make every kernel a good one.

The pictures contain a striking demonstration that the corn breeder must be a plant feeder, for the owner of this farm was following approved methods of breeding up his corn, but with little success until he fed the plants properly.

Examples of the above effects mights be multiplied indefinitely, but, perhaps, enough has been presented to induce you to take into consideration some points that are too often neglected in your efforts to improve your corn or your soils.

CORN VARIETIES.

(M. F. Miller, Professor of Agronomy, Agricultural College.)

The wide variation in the adaptation of different varieties of corn to soil and season is fully recognized by the observing corn grower. A corn that is well adapted to rich bottom lands rarely does so well on thin uplands, while a corn that will produce satisfactory results on a soil that is well worn is usually too small for the bottoms or more fertile soils. In selecting corn for seed, therefore, it may be given as a general rule that the soil on which a variety of corn has been grown should be as nearly as possible like that on which the seed is to be planted. There has been considerable discussion on this point by practical farmers, many contending that in order to produce good seed corn the best ground on the place should be selected for growing it. Others contend that corn grown on thin land will have greater feeding capacity, and, therefore, greater possibilities for a large yield. Experiments and the experience of plant breeders, however, point to the conclusion that for corn to do its best the soil should not be far different from that on which the seed was grown.

The climatic differences, of course, have a great effect on the character and growth of corn, while the effect of season is too well known to need comment. As a general proposition it can be said that for the highest yields the variety grown should have a growing season sufficient to just use up all of the time before frost—no more, no less. Should the variety be early, and should there follow two or three weeks of good corn weather, after it has matured, the yield will not be so great as with a variety which had this extra time for growth and the production of starch. On the other hand, a late variety, caught by the frost, will not fill out its full amount of starch, and the grains will be shrunken, usually low in vitality, always loose on the cob. Should a locality be subject to drought, however, the variety best adapted will depend upon the time the drought comes. If it comes early, a rather late corn that will not reach the critical time (the shooting stage) until after the drought has passed, may be best; if the drought is late, an early variety that will pass this critical time before the drought comes on will doubtless prove best. Since one cannot forecast the weather, the only thing that can be done is to prepare for the weather that is most common by planting the variety which will come nearest fitting average seasons. The problem of finding the variety best adapted to any particular soil or locality is one of great importance to the farmer, and one which it may take years of experimenting to solve with perfect satisfaction. One of the most important tasks of the cornbreeder is the developing of strains that are perfectly adapted to certain conditions of soil and climate. A corn may have finish and style, so far as the score card is concerned, and still lack an adaptability on this soil or that which can be imparted to it only by continual selection through a series of years. This does not mean that a corn must necessarily be grown in the same neighbrhood to be best for seed, as well-bred varieties from a distance frequently do much better than home grown varieties, although as a general rule this is not the case, and the nearer home seed corn is secured the greater the chances for a profitable crop. With the average man, however, who has given very little attention to the matter of careful selection of his corn, the variety is usually of more importance than the locality where it has been grown.

It was with the idea of determining those varieties of corn which were best adapted to the various parts of the State that the experiment station began two years ago a co-operative variety test of corn with farmers living in various parts of Missouri. These men were sent a number of varieties of corn representing all the promising types for the State, with instructions for planting these side by side on uniform soil, and for giving them the same care throughout the season. Notes were taken on the time of maturity, character of growth, and other characteristics that indicated the adaptability of the varieties to the conditions and the yield per acre of each variety was determined at harvest time.

The first year's test was preliminary and included reports from only about 25 men, but the test for 1906 included 100 men, most of whom reported their results.

The varieties under test in 1906 showed the following rating when all the tests were averaged. This rating was secured by giving a percentage valuation to the ranks which the various varieties held, as reported by the various men, and dividing by the number of reports received:

Variety.	Rating.
1. Boone County White	348
2. St. Charles Yellow	194
3. Farmers' Interest.	162
4. Reid's Yellow Dent	156
5. Johnson Co. White Dent	122
6. St. Charles White	118
7. Legal Tender	108
8. Leaming	74
9. Silver Mine	56
10. McAuley's White Dent	22

Boone County White, as is commonly known, is a large white corn, rather rough in indentation and inclined to coarseness. It is a late variety, adapted to rich land, and is especially valuable along the Missouri and Mississippi river bottoms. It has yielded far ahead of the other varieties both years of the test. A part of this may doubtless be accounted for from the fact that the average man, when sent corn for test, wants to make a good showing, and even when requested to plant it on land that will represent the country in which he lives, he will usually select the richest piece. Under such conditions the Boone County White will naturally show great superiority over most of the other varieties. St. Charles Yellow is another rather large corn somewhat inclined to roughness and coarseness and seemingly best adapted to rich lands. It is also a late corn, and therefore has practically the same adaptations as the Boone County White, although it is somewhat inclined to a softer cob and poorer germination, which interferes with its yield. For a large yellow bottom land corn, however, it stands well toward the top.

Farmers' Interest is a large white corn, resembling very closely the Boone County White, but a little rougher and later in maturity. It has practically the same adaptations as the Boone County White. It is not so well adapted to Missouri conditions, however, the seed for the test being secured from Indiana.

Reid's Yellow Dent is a medium-sized yellow corn, very compact, with well-filled butts and tips as a striking character. The depth and size of kernel are only medium, and it inclines to a smooth indentation. It has a special adaptation, according to indications thus far observed, to be particularly adapted to the prairies of North Missouri. It is of medium early maturity, sound, has a fine appearance, and shows careful selection.

Johnson County White Dent is a large white corn, closely resembling Farmers' Interest in general character, and with the same adaptations. The seed for the test was secured from Indiana in 1906, which may partly account for its low average.

St. Charles White is a native Missouri variety, familiar to most farmers in the southern half of the State. It is a medium-sized variety, with a rather rough indentation and a blood red cob. It matures rather late. Experiments seem to indicate that it has a special adaptation for those regions subject to an August drought, such as the tier of counties along the Kansas line, south of Kansas City. Experiments are not conclusive as to this point, however.

Legal Tender is a rather large, coarse yellow corn. It has little type except to be rough, rather wide grained, and uniformly yellow. Its peculiar adaptations are not clearly indicated, but probably it will require rather rich land and a fairly long season, as it is somewhat late in maturity.

Leaming is a standard corn of Illinois, which does not seem to have gained much favor in Missouri. The tests do not show a high yield, nor do they indicate its adaptations except that it seems to be at its best on the prairies of North Missouri. It is a medium to large variety, inclined to a decided tapering ear and to irregularity of kernels. These characters are rapidly being bred out of it, however. It is of medium maturity.

Silver Mine is a medium small white corn, early in maturity. It is particularly adapted to those regions where a late drought is common. It is small of stock, and the earliest in maturity of the varieties under test. The test was not quite fair to the Silver Mine, since not all the co-operators received this variety, thus cutting down on its general average.

McAuley's White Dent is rather a coarse, wide-grained medium late variety from Kansas. It had the same disadvantage as the Silver Mine, in that only a part of the co-operators received it, thus cutting down the rating. Little can be said at this time regarding its adaptability to Missouri conditions.

This test is by no means conclusive, but it offers suggestions as to the adaptations of these varieties to the various regions of the State. The test for 1907 is being planned along the same general lines with the introduction of one or two more varieties. The variety of corn which a man grows is of great importance, and another year should see certain varieties of corn recognized as standard by the Corn Growers' Association, the eligibility to recognition being based on performance in field and show room. The importance of growing standard types of corn is as great as the importance of growing standard types of animals, and should not be overlooked by the progressive farmer.

RESOLUTIONS.

We, your Committee on Resolutions, beg leave to submit the following resolutions, and recommend their adoption:

1. That the Missouri Corn Growers' Association, in fourth annual convention assembled, announce our appreciation of the great value to farmers of this State of the work that has been done for the improvement of our leading grain, corn, by the State Board

of Agriculture, through our State Meetings and the Farmers' Institutes.

2. We recommend that the 44th General Assembly make provision for the extension of the work now in progress at the Experiment Station in the test of corn varieties, crop rotation, fertilizers and methods of cultivation in combination with a State Soil Survey.

3. That the Legislature increase the amount appropriated to the State Board of Agriculture for Farmers' Institute work, so as to make it possible to hold a Boys' Corn Growing Contest and Corn Institute in every community where such a meeting may be desired.

4. That we should admit to compete for prizes at the State and county corn shows any corn that shows unmistakable evidence of having been systematically bred to a definite type and for a reasonable time.

5. That we appreciate the work of Dean Waters, Secretary Ellis, Prof. Miller, for the able and efficient manner in which they have contributed to the success of this meeting.

6. That all corn growers and farmers who are interested in the improvement of the greatest grain crop of Missouri are invited to become members of this Association.

7. That a regular business session of the next annual meeting be held on the second day of Farmers' Week.

8. That the members of the 44th General Assembly be urged to make an appropriation of not less than $200,000 for the erection of an agricultural building for the use of the State Agricultural College, the State Board of Agriculture, and which building shall contain a suitable assembly hall in which may he held our State agricultural conventions and corn shows. We would call to the attention of our legislators the inadequacy of the present agricultural building, which is entirely too small and not at all suited for the purposes for which it is now used.

9. That we express our appreciation for the valuable assistance given in contributions of the Commercial Club of Columbia, the Missouri Jamestown Commission, the State Board of Agriculture, and the manufacturers who have furnished money and implements for prizes.

THE PRIZE WINNERS FOR THE CORN SHOW WERE ANNOUNCED AS FOLLOWS:

In the best 100 ears of white corn, first, second and third prizes went to J. P. Hendricks, Columbia, Mo.; E. T. Long, Fayette, and Hopson Park, Lowry City, respectively. H. R. Scott of Tarkio carried off first honors with his 100 ears of yellow corn; second prize in this section was won by H. T. Crane of Elmo, while S. H. Riebel came in as a close third. The much coveted grand sweepstakes› a Great Western manure spreader, valued at $120, was won by H. R. Scott of Tarkio, Mo., on his 100 ears of yellow corn. J. P. Hendrick of Columbia, H. T. Lane, Herman Schultze, Warrenton; J. B. Inman, Columbia; P. E. Crabtree, Hannon, and G. H. Sly, Rockport, were the winners in the order named for the best 20 ears of white corn. The prizes in the yellow corn class fell to F. H. Reibel, Arbela; H. C. Crane, Elmo; J. H. Sly, Rockport; J. C. Curry, Rockport; H. R. Scott, Tarkio; E. B. Crane, Elmo, respectively. This show still maintains a class for mixed variety. In this contest first prize was captured by E. L. Hewitt, Harrisonville; second, Hopson Park, Lowry City; third, E. J. Hughes, Glasgow; fourth, Fritz Ohlendorph, Boonville; fifth, C. C. Sullivan, Lamar. In this class grand sweepstakes prize was awarded to F. H. Riebel, Arbela. The prize consisted of a Black Hawk corn planter, valued at $40.00. J. H. Sly, Rockport, won the sweepstakes prize for exhibiting the best 10 ears in a contest where six varieties were exhibited. The $50.00 silver trophy, offered by the Missouri Commission to the Jamestown Exposition, was won by Wm. Johnmeyer, Boonville. The cup was offered for the best display of 10 ears for a number of varieties. Mr. Johnmeyer had ten varieties on exhibition. His closest competitors had only six varieties. This corn, together with the trophy, will form a prominent part of the Missouri exhibit at the Jamestown Exposition.

CLASS C, SECTION 1.

BOONE COUNTY WHITE.

First—J. E. Matheny, Miami.
Second—Hopson Park, Lowry City.
Third—J. P. Hendrick, Columbia.

LEAMING VARIETY.

First—James B. T. Edwards, Bowling Green.
Second—Wm. Johnmeyer, Boonville.
Third—P. E. Crabtree, Hannon.

FARMERS' INTEREST.

First—Ernest L. Hughes, Glasgow.
Second—Chris. Lynn, Centralia.
Third—I. G. Wiggington, Warrenton.

REID YELLOW DENT.

First—R. B. Johnson, Boonville.
Second—H. C. Crane, Elmo.
Third—J. K. Fifer, Pierpont.

ST. CHARLES WHITE.

First—J. H. Sly, Rockport.
Second—Ray Harmon, Eastman.
Third—Wm. Johnmeyer, Boonville.

CARTNER VARIETY.

First—C. Ohlendorph, Boonville.
Second—Chris Smith, Bunceton.
Third—J. W. McFarland, Bunceton.

THE IMPROVEMENT OF MISSOURI HERDS.

WHY AND HOW.

(From second annual report State Dairy Commissioner of Missouri, R. M. Washburn, Commissioner.)

The increase in the standard and cost of living of the American people, the greatly increased demand for higher education and the increase in the price of land in this State, have all worked together to make it necessary for the farmer to make more money. With his farm gradually becoming less productive, while at the same time being taxed as though worth more, how is he to do this? He must keep stock in order to save his land. Most farmers now possess a goodly number. How to handle this stock in order to realize the most from it is now the most vital question before the Missouri farmer. The time has passed when he can afford to keep a cow the entire year for her calf only. She must do more. About twenty-five thousand farmers of this State have already solved this question in a measure by using the cows that they have in a dual capacity. Those cows must now produce milk and cream for market as well as raise their young. This group of dairy farmers, or balanced farmers, have learned that by milking their cows and selling the cream they can and do receive from twenty-five to seventy-five dollars a year from each cow, and still raise the calf as well as before. The following table shows sums actually obtained by the patrons of different small creameries in this State:

Name.	Address.	No. cows.	No. of months.	Money received	Cow per month.	Cow per year.
J. A.	Kirksville	8	12	$393	$3 98	$47 87
J. S. B.	"	6	4	113	4 70	
G. W.	"	9	10	233	2 58	
W. F. P.	Lovelake	6	9	149	2 75	
H. R.	Corder	12	12	572	3 87	47 66
C. B.	"	12	12	673	4 67	56 08
D. G.	Holden	20	12	1,002	4 17	50 10
J. E.	"	8	12	413	4 27	51 25

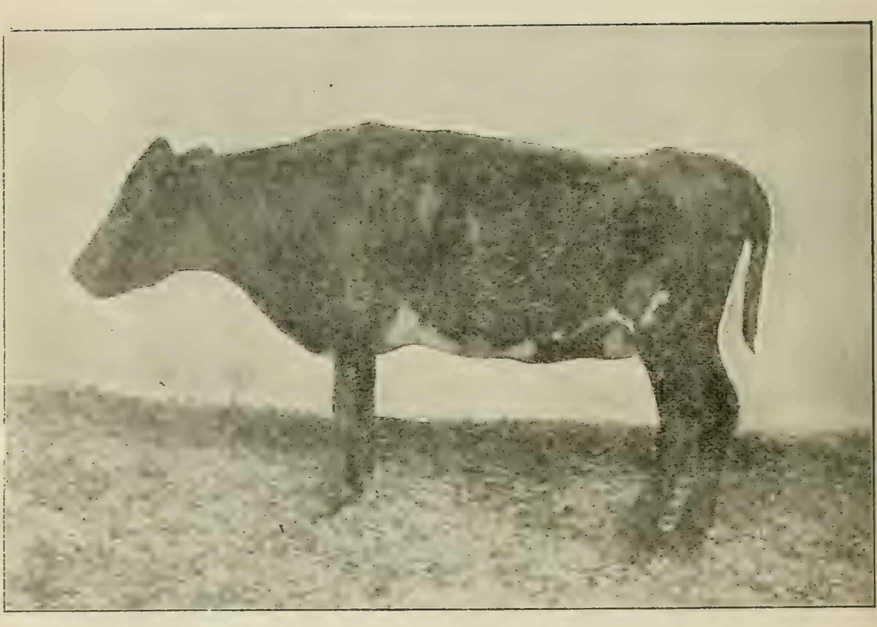
Imported Comassie, rear view.

Imported Comassie, 11,874. A high producing Jersey, side view.

Name.	Address.	No. cows.	No. of months.	Money received	Cow per month.	Cow per year.
A. O.	Sweet Springs	8	6	$173	$3 58	
A. H. K.	" "	10	6	233	3 88	
W. L. H.	" "	10	6	215	3 58	
J. B. B.	Billings	2	12	94	3 91	$47 00
J. J. K.	"	7	12	276	3 28	39 42
G. H.	"	7	12	335	3 98	47 85
W. A.	"	10	12	427	3 50	42 00
A. D.	"	10	12	336	2 80	33 60
C. R.	Palmyra	28	12	1,550	4 61	55 35
B. R.	"	16	12	1,052	5 47	65 75
F. G.	"	18	12	1,228	5 59	67 11
L. G.	"	12	12	780	5 41	65 00
W. E. B	Carrollton	25	12	918	3 06	36 72
J. W.	"	7	12	216	2 57	38 85
F. D.	Hamilton	14	12	563	3 35	40 21
H. G.	"	12	12	495	3 43	41 25
J. S.	Lamar	8	9	289	4 01	
C. F. B.	"	15	12	659	3 66	43 93
E. F.	"	16	12	685	3 56	42 81
N. M.	"	15	4	180	3 00	
R. W. S.	Valley Park	3	$2\frac{2}{3}$	43	5 40	
L. A. M.	Emma	8	12	461	4 80	57 62
C. W.	"	11	12	507	3 84	46 09
H. H.	La Grange	6	12	447	6 20	74 50
A. M. H.	"	17	12	1,258	6 31	75 76

The above figures show only the money actually obtained from the sale of cream, not what the cows produced. We do not know how many people consumed milk, cream and butter at home. It would naturally be expected that those cows in a large herd should show a better average record than those in a small herd because of this home consumption.

Notice in the above table that the smallest yearly return for one cow is $33.60. This figure is not great, neither does it represent the entire year's earning of the cow. Her calf, raised on skim milk, was worth as much as it would have been had it consumed that $33.60 worth of fat. Moreover, pigs were fed on the excess milk, which would again raise the real valuation of the cow when used in a dairy manner.



This cow gave in one year—milk, 3,136; test, 3.64; butter fat, 133 lbs.

(Courtesy of Hoard's Dairyman.)

COST PER HUNDRED POUNDS' GAIN IN PIGS.

Corn at 40 cents per bushel, skim milk at 15 cents per cwt.

Fed on	Cost per 100 lbs.
Corn and bluegrass	$3 92
Corn and rape	3 49
Corn and clover	3 20
Corn and alfalfa	2 96
Corn and skim milk	2 84

If, by milking a cow, she may be made to produce $50.00 a year, or even $30.00 a year more cash than when she is not milked, there certainly should be more men engaged in the business. Notice that A. M. H., LaGrange, Mo., realized an average of $75.76 cash per cow per year. These men are they who pay for their groceries at the time of purchase, so that when the corn crop and the hog crop are sold that money may be used for payment on the farm or in the improvement of buildings.

Big Difference With Same Market.—But notice what a difference there is between H. R. and C. B., both of Corder, with the same number of cows; C. B. receiving $101.00 more than his neighbor. Again, this is apparent in the case of A. D. and W. A. of Billings, each with ten cows milking for one year, yet W. A. receiving nearly $100.00 more than his neighbor. Both these, mind you, sold their produce at the same factory. It is quite apparent that either W. A. has better stock or that he gives better care, for he made a third more during the year than his neighbor, with the same number of cows. Glancing down the column giving income per cow per year, we find a great variation; the yearly income varying all the way from $33.60 to $75.76. Though this variation be great, the net income would show a greater difference. It may reasonably be figured that the manure, and the skim milk for the feeding of pigs and calves, pay for the work bestowed on the cow. Assuming that it cost $35.00 a year to feed a cow, the net *loss* on the lowest would be $1.40, while the net *profit* with the highest would be $40.76, one cow being over forty times as profitable as the other.

Select the Cows Within the Herd.—Only a few years ago it was thought that a pedigree was a guarantee of profit, but not so today. Although the dairy-bred herds have a much higher percentage of profitable individuals, it yet remains that all breeds have some inferior members. Cows belonging to the "no breed" breed are far more likely to be inferior than their better bred neighbors. Unfortunately, but few records have been kept as yet by the farmers of the State. Notice the following records. These men feed the skim milk to calves and pigs, thus greatly increasing their actual profit:

HERD RECORD OF T. G. HALL, WINDSOR, HENRY CO., MO.

No. of cow.	No. of months milking.	Amt. of milk. in lbs.	Aver. % of fat.	Lbs. butter food.	Cost of fat.	Profit.	Profit per mo.	Remarks.
1...	10 mos. 24 days.	7,878	4.75	373.2	$29 15	$28 02	$2 60	This cow is a registered Jersey.
2...	9 mos. 8 days.	4,111	5	205.55	About same. above.	7 84	22	This cow was poorly handled last year.
3...	8 mos. 20 days.	4,766	5.5	262.13	30 00	17 18	1 98	This is a two-year-old.
4...	4 mos. 20 days.	3,432	6	205.92	12 75	24 31	5 20	This is an Island bred Jersey with her third calf.

Notice that cow number 4 gave more than three times the net profit obtained from number 2, and in half the time.

HERD RECORD OF R. L. HARBAUGH, LIBERTY, CLAY CO., MO.

No. of cow.	No. of months milking.	Amt. of milk in lbs.	Aver. % of fat.	Lbs. fat.	Cost of food.	Profit or loss.	Remarks.
1......	7½	4,317	....	To	July	1st.	An old cow. Have no record.
2......	7	4,855	....	"	"	"	Sent to the block.
3......	8	4,826	....	"	"	"	Still milking.
4......	6⅓	3,318	....	"	"	"	Sold for beef.
5......	13½	6,144	2 yr.	old cow	first	calf.	Calved June 7, 1905, any milked to July 18, 1906.
6......	8½	3,559	2 yr.	old cow	first	calf.	
7......	5⅔	4,265		To	July	1st.	Freshened in January.
8......	2⅔	2,441	"	"	"		
9......	1½	1,268	"	"	"		

"I do not test each cow, but ship my cream to creamery. Amount butter fat for six months ending on June 30 was 707 pounds, and we churn for our own use besides. R. L. H."

The above record, though not complete, shows that unless No. 6 can offer a very good excuse for having given only 3,559 pounds of milk in 8½ months, she could be disposed of. No. 7, milking only 5 2-3 months, gave considerably more milk.

C. S. Russell, Ironton, Iron County, Mo., says: "I had nine

This cow, DeKol Hengerveld Belle, gave in nine months 11,261 lbs. milk, which contained 456.07 lbs. butter fat, equal to 532 lbs. butter.

(Courtesy of Hoard's Dairyman.)

Jersey cows when I began testing and weighing the milk from each cow separately.

Best cow	1 year.	6,050 lbs. milk.	test 4.5	272.25 lbs. butter fat.
Poorest cow	1 "	2,700 " "	" 3.6	97.20 " " "

I found only four out of the nine that were worth keeping."

Wesley P. Lummis, Pleasant Hill, Cass Co., Mo., took charge of a herd of well-bred Shorthorn cows and placed every member of the herd on her own merits, and says: "After two years of weighing and testing, giving the cow credit for everything she gave me, and charging her with all I gave her, I found that only *one-third* of the number paid their way."

A. J. McDowell, Fordland, Webster Co., Mo., says "In 1905 I milked 15 cows. Six yielded less than 150 pounds of butter fat each. One only 90 pounds. Seven between 150 pounds and 250 pounds, and two over 300 pounds. I kept four of the best cows and sold eleven, tried to buy some better ones, but failed, and am now breaking in heifers, which I have raised. I cannot tell exactly what it costs me to keep my cows, but I have approximated it, and I think they cost me about $30.00 a year each, besides the pasture.

HERD REPORT FOR 1906.

Name of cow.	Age.	Lbs. of milk.	Test.	Lbs. of butter fat.
Rose	2 yrs.	5,670	5.5%	311.85
Mary	3 yrs.	5,507	5.6%	308.39
Hattie	3 yrs.	5,102	5 %	255.10
Joe	Mature cow.	6,792	4.8%	326.01
Inez	"	5,889	5.5%	323.89
Jersey	"	4,340	6.1%	264.74
Bess	"	5,326	5.2%	276.95

I milked several other cows during 1906, but none during the whole year, as I was buying and selling, trying to improve my herd. I have given that up now and am raising a herd from a registered Jersey bull. I think that is the only practical way to get a good herd."

HERD RECORD OF C. J. W. JONES & SONS, ROANOKE, HOWARD CO., MO.

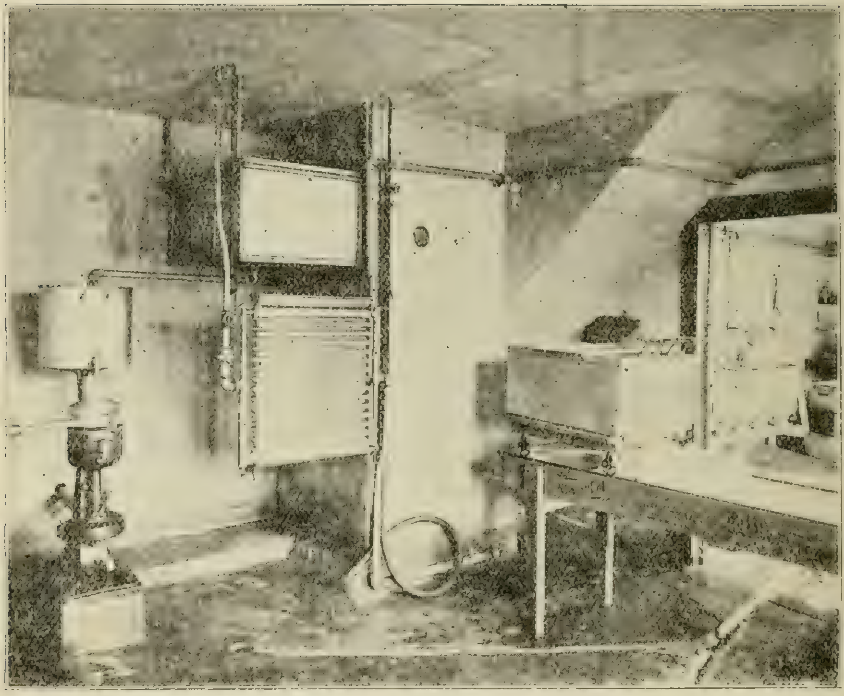
No. of cow.	No. of months milking.	Amt. of milk. in lbs.	Aver. % of fat.	Lbs. butter fat.	Cost of food.	Profit or loss.	Remarks.
1.....	10½	2,490.9	4.3	108.1	*.......	*.......	Lost calf and did badly. Never recovered. Record better this year.
2.....	11	5,432.2	4.5	344.4	....	....	Record this year will be better than last.
3.....	12	5,663.1	4.1	295.3	....	....	Missed one day's milk in the year.
4.....	9	3,002.1	4.0	120.1	....	....	No good. Sold to butcher.
5.....	9 mos. 20 days.	7,394.3	4.0	295.80	....	....	Best cow in herd at present Grade Shorthorn.
6.....	10	4,384.8	5.5	241.16	....	....	Grade Jersey. Fair performer.
7.....	10 mos. 17 days.	4 597.4	3.5	160.9	....	....	Good grade Shorthorn. Second calf.
8.....	10 mos. 17 days.	3,809.5	3.6	137.14	....	....	Has one-quarter of udder ruined. Cut by wire.
9.....	9	3,833.8	4.1	157.2	....	....	Her record will be 1000 lbs. better this year.
10....	10	5,951.5	3.1	184.5	....	....	Grade Holstein. Bought her and she was milking one month.
11....	10	6,060.8	3.8	230.31	....	....	Grade Shorthorn. A good cow with stricture in one quarter.
12....	10	6,086.3	4.5	273.88	....	....	Had this cow been trained when young she would be a better cow at least this year.
13....	10	4,863.3	4.3	209.3	....	....	A promising heifer. Mother being No. 12 and father an Angus.
14....	9	3,739.1	5.2	184.4	....	....	Grade Jersey. Record this year much better than 1905. Mother is No. 6.
15....	10	4,058.0	5.2	210.1	....	....	Grade Jersey Has improved during 1906.
16....	8	4,294.5	4.3	184.66	....	....	Angus. Sold for beef. Poorer than last year.
17....	6	2,744.0	3.5	96.04	....	....	Angus. Sold for beef.

*Unfortunately, I have no record for the above two items .

"From experience in my herd I find: First, that the color of the milk does not indicate the richness of the milk, as might be expected; second, the cows that you may pick as your best will often rank low in butter fat and yield in pounds; third, each cow should be tested for richness of butter fat and the milk weighed twice daily during the lactation period; fourth, read all available dairy literature and take the advice of authorities."

Respectfully,

C. J. W. JONES & SONS.



View of a portion of the model dairy at Hillcrest Farm, Greenwood, Mo., showing sterile receiving tank for milk which is emptied from the outside, the ærator, turbine separator and automatic bottler. The turbine bottle washer, the sterilizer, the refrigerator and the icing room are not shown in this picture.

Just notice the record made by No. 4. Only 120 pounds butter fat during the same period of time and on the same food as No. 5, who yielded 295 pounds butter fat. Notice also No. 17. Ninety-six pounds butter fat in six months. She certainly was not intended for dairy purposes.

S. W. Coleman, Sedalia, Pettis County, Mo., says: "I have never made a record of any one cow. It has been inconvenient for me to do so, although I expect to at some future date. The only record is on the herd, which is 400 pounds butter to the cow in tweve months."

HERD RECORD OF P. THEISS, WARRENSBURG, JOHNSON CO., MO.

Name of cow.	No. of months milking.	Amt. of milk given.	Aver. % of fat.	Lbs. butter fat.	Cost of food.	Profit.	Profit per month.	Remarks.
		per day lbs.						
Betty	5	36	3½	179	$11 00	$24 80	$4 69	
Bessy	5	35	4	210	11 00	31 00	6 20	
Pearly	5	34	6	306	11 00	50 20	10 04	
Wite	5	30	4	180	11 00	35 00	7 00	First calf.
Boss	5	28	4½	189	11 00	36 00	7 20	" "
Susy	5	28	4½	189	11 00	36 00	7 20	" "
Kate	4	28	5	168	9 00	24 60	6 15	" "
Daisy	4	32	6	230	9 00	37 00	9 25	
Topsy	10	20	4	240	22 00	26 00	2 60	First calf.
Lilly	10	20	5	300	22 00	38 00	3 80	" "
Jersey	14	20	6	504	32 00	68 00	4 85	

"From experience in my herd I find that it is the only way of doing business, and that a man don't know what he is doing any other way."

As a whole, the above record is a good one; so also is the conclusion reached by this careful gentleman.

Professor C. H. Eckles, Department Dairy Husbandry, Agricultural College, Columbia, Mo., says regarding the College herd:

Best Jersey	Av. 4 years	8,065 lbs. milk	376 lbs. fat.
Poorest Jersey	Av. 5 years	3,290 lbs. milk	186 lbs. fat.

Single milking period records of above cows:

Best Jersey	1 year	10,200 lbs. milk	465 lbs. fat.
Poorest Jersey	1 year	2,443 lbs. milk	124 lbs. fat.

Best and poorest records of entire herd above three years of age:

Jersey	1 year	10,200 lbs. milk	465 lbs. fat.
Jersey	1 year	2,607 lbs. milk	115 lbs. fat.

Best Holstein	1 year	12,096 lbs. milk	410 lbs. fat.
Poorest Holstein	1 year	7,755 lbs. milk	245 lbs. fat.

	Age.	Lbs milk	Lbs. fat.	Cost feed.	Amount profit on butter fat.
No. 21	2 years	6,750	337	$35 00	$52 62.
	3 years	6,988	364	38 00	56 64.
No. 62	2 years	878	44	30 00	18 56 loss.
	3 years	2,607	115	32 00	2 10 Loss.

"No. 21 and No. 62 are both registered Jerseys, raised on the College Farm. They were sired by the same bull, and their mothers were somewhat related. Both were raised under the same conditions and have had the same kind of food and treatment all their lives. During the two milking periods both have received practically the same ration, except No. 21 was given somewhat more on account of her greater appetite. The difference in the production of these two animals can only be attributed to their individuality.

The average production of the cows above two years old in dairy herd in 1906 was 85 lbs. of butter fat more than the average production in 1901. This improvement has been brought about by culling out the inferior animals. About one-third of the herd on hand in 1901 was sold on account of their low production."

ILLINOIS, AS REPORTED BY W. J. FRASER.

Comparison in Milk Production.—"The cows in the better herd were picked up here and there at moderate prices. They have been producing milk throughout the year at the rate of 18 cans to 45 cows, or 2½ cows to a can (8 gallons). The latter herd has been yielding at the rate of 5⅓ cans to 34 cows, or 6.4 cows to the can.

"When milk sells at $1.15 per hundred pounds, this means that the average cow in the better herd produces 29½ cents' worth of milk per day, or $88.50 worth as the total for a year of ten months. The poorer herd yields 11½ cents' worth of milk per cow per day, or $34.50 worth for the year. There is some difference between these cows and their incomes. (See figs, 12 and 13.)

"If it costs $32 per cow for feed in the poorer herd, just $2.50 per head is left as the profit for one year. But if the better herd is fed at $40 per cow, it leaves $48.50 per head as a profit. Here is a difference of $46 in clear gain, or, in other words, it takes 19 cows of the one kind to equal one cow of the other kind. In a herd of 40 cows this difference would amount to $1,840.

"If a man desired to make $1,000 per year profit in the dairy business, he would have to keep 400 of these poor producers. But he would get the same results with 21 cows like those in the better herd."

IOWA.

Comparative records of the cows kept at the Iowa Experiment Station, Ames, Iowa, as reported by Mr. C. H. Eckles, who had charge of the herd during the time this record was made.

BUTTER FIGURED AT 20 CENTS PER POUND AND SKIM MILK AT 20 CENTS PER CWT.

Description of cow.	Lbs. of milk produced per year.	Lbs. butter produced per year.	Cost of feed.	Net profit.
Best Holstein	12,111	538	$29 83	$97 15
Poorest Holstein	6,667	246	21 71	38 16
Difference	5,444	292	$8 12	$58 99
Best Shorthorn	9.869	474	$27 38	$83 25
Poorest Shorthorn	3,059	129	23 83	6 86
Difference	6,837	345	$3 55	$76 39
Best Red Pole	7,225	361	$25 32	$58 44
Poorest Red Pole	5,249	236	25 24	30 36
Difference	1,976	125	00.08	$28 08
Best Jersey	6,523	532	$26 26	$90 58
Poorest Jersey	4,087	236	18 54	35 20
Difference	2,436	296	$7 72	$52 38

Notice the difference between the best and the poorest Holstein, both pure, one making two and one-half times more money in the year than the other. Notice again the extra difference in profitableness of the Shorthorns, the best more than 12 times as profitable as the poorest. The Red Poles offer a very neat condition, there being only eight cents difference in the cost of their

For profit

19 of these cows equals 1 of the other herd.
190 of this kind equals 10 of the other herd.
380 of this kind equals 20 of the other herd.
760 of this kind equals 40 of the other herd.
1520 of this kind equals 80 of the other herd.

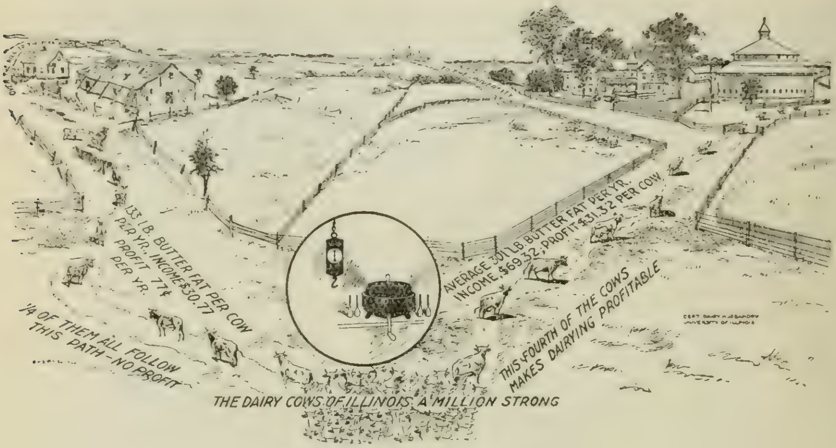
(Courtesy of Prof. W. J. Frazier of Illinois.)

For profit

1 of these cows equals 19 of the other herd.
10 of this kind equals 190 of the other herd.
20 of this kind equals 380 of the other herd.
40 of this kind equals 760 of the other herd.
80 of this kind equals 1520 of the other herd.

(Courtesy of Prof. W. J. Frazier of Illinois.)

feed for a year, yet there is $28.08 difference in the net profit obtained. The Jerseys are found to vary in about the same proportion as the Holsteins.


133 LB. BUTTER FAT PER COW PER YR. INCOME $30.77 PROFIT 77¢ PER YR.
1/4 OF THEM ALL FOLLOW THIS PATH—NO PROFIT
AVERAGE 301 LB. BUTTER FAT PER YR. INCOME $69.32, PROFIT $31.32 PER COW.
THIS FOURTH OF THE COWS MAKES DAIRYING PROFITABLE
THE DAIRY COWS OF ILLINOIS, A MILLION STRONG

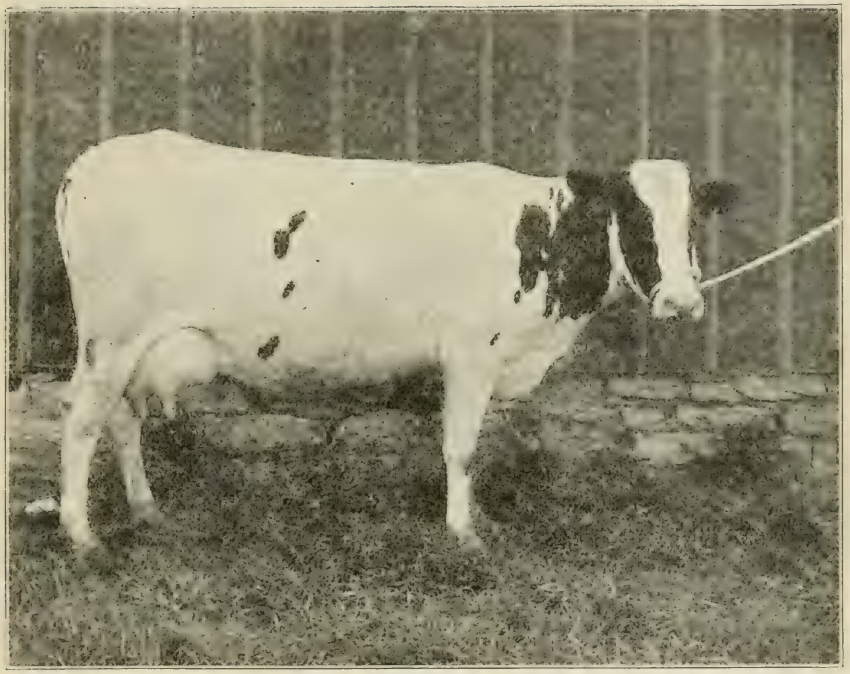
The whole story in a nutshell.
(Courtesy Farmers' Tribune.)

NEW YORK, CORNELL STATION, AS REPORTED BY H. H. WING.

Records of herd shows that Daisy produced 2,829.75 pounds of milk and made butter fat at cost of 26 cents a pound, while Freddie gave 11,165.00 pounds of milk and made butter fat at 12½ cents per pound. Daisy produced milk at $1.48 a hundred pounds; Freddie produced milk at 47 cents a hundred pounds during same year on same feed.

OHIO, AS REPORTED BY C. G. WILLIAMS.

Record of the Station herd showed that Patti's 5th, during a certain experiment period, gave 2,967.1 pounds of milk, with a profit over feed of $25.93, while Vanity's 2nd, during same time and on same feed, gave only 819.4 pounds milk, with a profit over feed of $3.43. Another group, same Station, Nelly's 4th, 2,861.9 pounds of milk, with a profit over feed of $16.44, while on the same feed and during the same time Fancy's 4th gave but 605.2 pounds milk and was fed at an actual loss of $1.94. Same Station reports for 1896 Daisy's 2nd gave 168.16 pounds fat, while Ruby, during the same year, gave 521.32 pounds fat. The work bestowed on these two animals was practically the same and the feed cost was not greatly different.



Holstein cow, Missouri Chief Josephine, property of Missouri Agricultural College. Age, 4 years 10 months; milk record, 1 day, 92.7 lbs.; 7 days, 613 lbs.; 30 days, 2,534 lbs. Year's milk record as a two-year-old, 10,284 lbs., and as a three-year old, 11,564 lbs.

ALABAMA, AS REPORTED BY R. W. CLARK.

Susan made 331.7 pounds butter, while Ada was making 168.4; Susan gave net profit of $58.71, while Ada gave but $17.85. In the year following Susan made a net profit of $48.25, while Clemintina was making $7.46.

MINNESOTA, AS REPORTED BY T. L. HAECKER.

In the year 1894 the cow Allie gave a total of 161.35 pounds butter fat, while Huston, on the same feed and the same stable, made 305.46 pounds butter fat. Allie barely paid her board, while Huston made a good profit.

ILLINOIS, AS REPORTED BY A. J. GLOVER.

Mr. Glover tested many herds over the State for a period of two years, and reports the best cow tested is Pet, herd N, who gave 428 pounds butter, while No. 6, herd A, was giving 158 pounds butter. He adds:

COMPARING THE AVERAGE PERFORMANCE OF TEN OF THE BEST COWS AND TEN OF THE POOREST COWS TESTED FOR TWO YEARS.

	Milk, pounds.	Fat, per cent.	Fat, pounds.	Days in milk.
Best cows	7,425	4.52	336	329
Poorest cows	3,841	3.74	144	262

The average production of the best ten cows was 3,579 pounds more milk and 194 pounds more butter fat per year than the average production of the ten poorest cows. While the average yield of butter fat by the best cows is about two and one-fourth times greater than the yield of butter fat by the poorest, yet the net profit is many times larger. To illustrate: If it takes 150 pounds of butter fat per year to pay for a cow's keeping, a cow that produces 151 pounds of butter fat per year returns to her owner a net profit of one pound of butter fat; if another cow gives 152 pounds of butter fat per year, she returns to her owner a net profit of two pounds of butter fat, or twice as much profit as the cow that produced 151 pounds of butter fat; therefore, the cow that produced 152 pounds of butter fat is twice as profitable a cow as the one that produced 151 pounds of butter fat, because she gives a net profit of two pounds of butter fat instead of one.

Question: How much more profitable are the best ten cows yielding 336 pounds of butter fat per cow per year than the ten poorest yielding only 144 pounds of butter fat per cow per year?

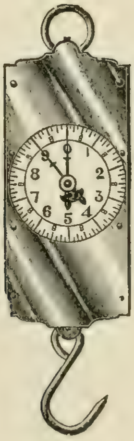
About $30,000,000 worth of dairy products are annually produced in the State (Illinois). The amount can easily be doubled with the same number of cows if the dairymen will give their business the attention it deserves.

The net profit from the cows of Missouri could easily be doubled in the next ten years.

MEASURING THE COW'S VALUE.

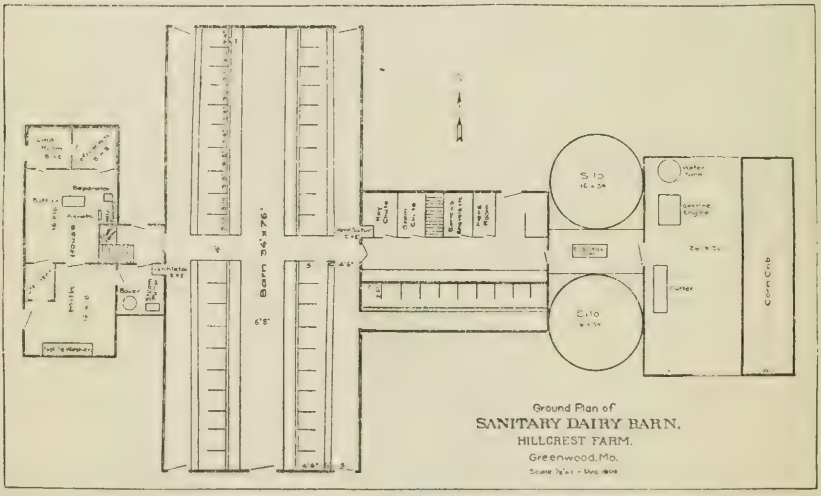
Testing Daily Not Necessary—Although it would be a little more accurate to weigh the cow's milk every morning and every night throughout the year and test it as often as once a week, such a procedure is too expensive to be of practical value on the farm. If the cow's milk be weighed and sampled for three days about the middle of each month, and the milk given by the cow for that month be estimated as ten times the quantity given in these three days, and then the test obtained from the composite sample of three days' accumulation be accepted as the test for the month, the results at the end of the year will be about 96 per cent. perfect. That is as close as the farmer need work.

Composite Samples—Pint Mason fruit jars are excellent for preserving these composite samples. Prepare one jar for each cow to be tested, label each jar with the number of the cow, then add to each jar a corrosive sublimate tablet, such as are obtainable from creamery supply houses. The poison in these tablets kills all bac-



Spring balance for weighing milk.
(Courtesy Blanke & Hauk, St. Louis.)

View of barn and silo, Hillcrest Farm, Dr. Geo. C. Mosher, proprietor, Greenwood, Mo


Separator
Butter
Aerator
House
16 x 16
Milk
Bottle Washer
Boiler
Steam Pump
Ventilator
2 x 2
Barn 34' x 76'
4'
6'8"
4'6"
Hay Chute
Grain Chute
Mans Room
Silo
16 x 34
Silo
16 x 34
Water Tank
Gasoline Engine
Cutter
Corn Crib
Ground Plan of
SANITARY DAIRY BARN.
HILLCREST FARM.
Greenwood, Mo.

Ground plan, dairy barn of Dr. Geo. C. Mosher, president Missouri Dairy Association.

teria in the milk, and thus prevents it from becoming sour. The pink color given to the milk by these tablets is merely for safety. Open jars cannot be used for composite work. So much of the water would evaporate from the milk that the test would be much too high. Arrange a permanent shelf in the cow stable for these sample jars.

Weighing—Secure a spring balance like that of Figure 17. Suspend it where the bucket of milk will swing freely, not touching the wall. When the cow has been milked clean (for the last milk is much richer than the first) hang the bucket on the balance, and record the weight immediately onto the permanent milk sheet, similar to that shown on page 78.

Now stir the milk three or four strokes with a dipper, which will hold about two tablespoonfuls, then dip out one measure, and add it to the bottle corresponding in number to the cow just milked. After the milk is added in this way, the sample should be whirled a little to mix the fresh milk with the poison previously placed in the bottle.

These several little steps require such a very small amount of time, when once the tools have been conveniently arranged, that it may be considered as taking no time at all. (The writer has done this sampling, weighing and recording of weight for each cow, and still milked thirteen ordinary cows in 65 minutes, though seventy to seventy-five minutes was the usual length of time.)

The form of milk sheet on page 78 is convenient. It may be copied onto tough paper, or full size sheets may be purchased from any one of several dairy publishing companies. This particular form is gotten up by Hoard's Dairyman, Ft. Atkinson, Wisconsin.

Permanent Records—Don't keep the permanent records on scraps of paper nor in pocket-sized books.

A book of 200 pages, each page 5½ by 11½ inches, can be purchased for 10 cents of 15 cents. Each page will hold the record of 30 cows for a month. Write the names or numbers of the cows down the left margin of the left-hand page, then rule up the remainder of the page like January (page 79).

Do not rewrite the names onto next page, but rule it for February near left side of page, so that the outer third of the leaf may be cut off, so that when turned it will just fit the names of the cows. Then on this narrow page rule for March, and so on. In this way, one writing of the names will answer for a whole year or longer.

SEVEN DAY MILK RECORD FOR TEN COWS.

DAILY RECORD FOR WEEK ENDING..............................190.. ....FARM

Date	M | Morning E | Evening	Name or number	Name or number	Name or number	Name or number	Name or number	Name or number	Name or number	Name or number	Name or number	Name or number
		Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.	Lbs.
	M										
	E										
	M										
	E										
	M										
	E										
	M										
	E										
	M										
	E										
	M										
	E										
	M										
	E										
Total.											

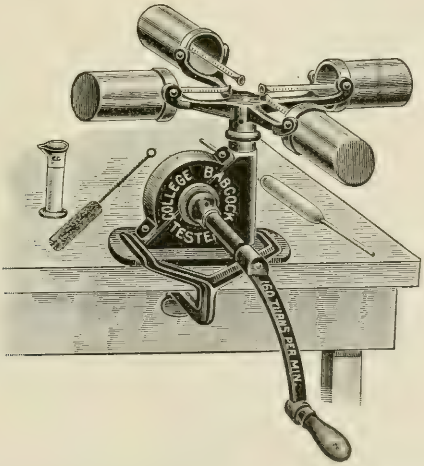
HERD RECORD FOR JANUARY, 190—.

Name or No. of cow.	Lbs. milk given in 3 days.	Estimate of milk per month.	Test from composite sample.	Lbs. of fat per month.
1	60	600	3.5	21.00
2	48	480	3.7	17.76
3	90	900	3.4	30.60
4	21	210	4.6	9.66
5	Etc.			
6				
7				
8				
9				
10				

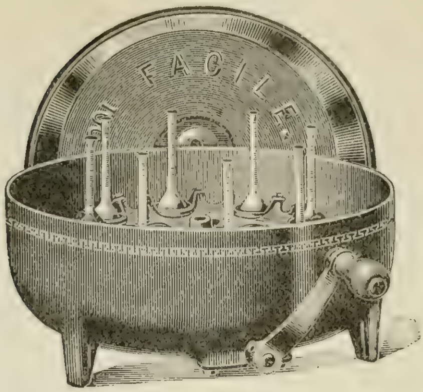
Sample page in permanent record.

HOW TO DO THE TESTING.

The testing of milk by the Babcock method is not difficult, either in operation or to learn; neither does it require much time to operate when learned.



This is a pretty good little tester, but not one to be recommended.
(Courtesy Blanke & Hauk, St. Louis.)



A good hand tester. Will last many years if reasonably well handled.
(Courtesy Blanke & Hauk, St. Louis.)

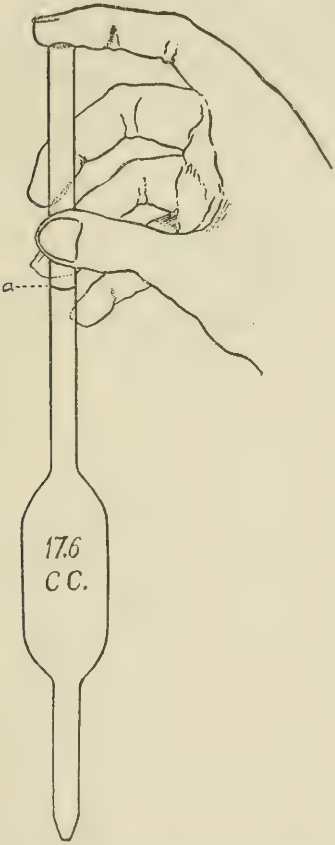
The Testing Machine—There are now several makes on the market, all of which are good. A simple machine, like Figure 18, will do the business very well, but is not so desirable as a heavier machine, in which the bottles are all enclosed and free from danger of being struck while in motion. A tester like figure 19 is the most satisfactory now on the market, and can be got at any creamery supply house for $9.00 or $10.00. Whatever machine is used, it must be fastened solid to a level stand or table before operating. Where it is to be used at intervals throughout the year, it is very important that it have a corner of its own somewhere, where it will be ready for operation any moment needed. To set it aside when not in use, with the intention of bringing it out and setting it up every time needed, means simply that after one or two months the work will cease. Arrange for convenience at first.

Glassware—Buy only good standard glassware, something which is guaranteed to be accurate. Accurate work cannot be done with inaccurate tools. Have a place for the glassware, and keep it there while not in use. More glass tools are broken by being left around carelessly than by the usage.

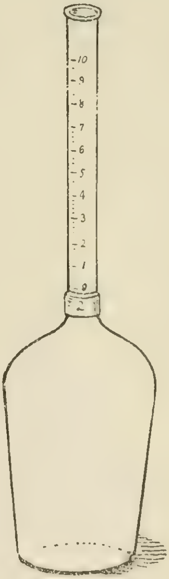
To Test Milk—Let us suppose that we have a sample of milk to be tested. The steps in the operation will be as follows:

First—Thoroughly mix the milk. If the cream clings to the side of the dish, warm it slightly in order that all of the cream may become thoroughly, very thoroughly mixed. This mixing is best done by pouring from one vessel to another and back again. A test bottle brush is also convenient in cleaning cream away from the sides. If there is any tendency on the part of the milk to foam, pour it down the side of the dish to prevent it. Remember, if there are many small bubbles of air in the milk, and you measure out a certain quantity, the actual quantity obtained is not sufficient, and the test will be low just in proportion.

Second—Now take the pipette, figure 20, and hold it in the manner shown. Place the lower end in the milk and the upper end in the mouth and draw the milk up into the tube nearly to the mouth, then let go with the lips and catch the end of the pipette with the forefinger, as shown in figure 20, then slowly allow the air to enter under the finger, thereby allowing the milk to drop down to the scratch A, then, being careful not to lose any of the milk, slip the point of the pipette into the top of the milk



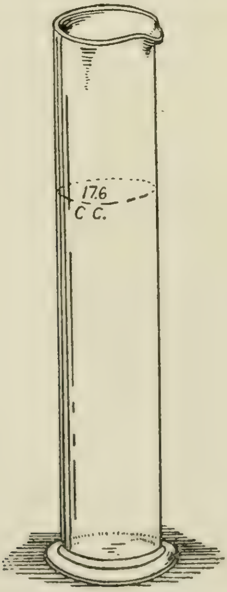
Pipette for measuring milk into test bottle.



Milk Test Bottle.

bottle, figure 21, allow the milk to flow slowly into the bottle. If bubbles of air cause a waste of any of the milk, empty the bottle, and try again. Always remember in testing that the sample taken is an exceedingly small part of the entire quantity, for which the reading of the sample is to give value.

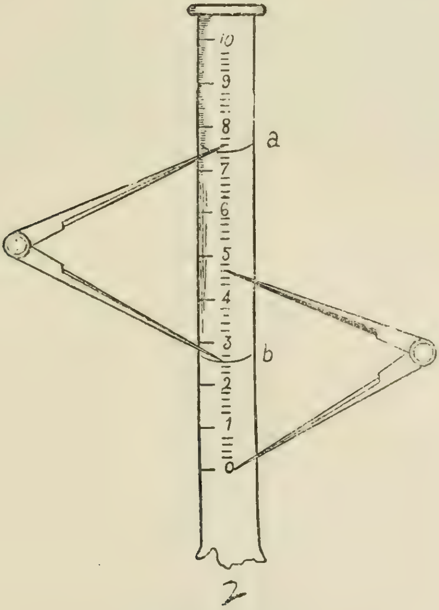
Third—Now take the acid measuring glass, figure 22, fill it with sulphuric acid to the scratch, which is usually about three-fourths of the way up. The acid is merely a tool. A few drops too much or too little will do no harm. Now hold the test bottle containing the milk, figure 21, in the left hand and at an angle of about 45 degrees, then carefully pour the acid from the acid measure into the sample of milk, allowing it to run slowly down the side of the bottle, gliding gently under the milk. If the bottle be held upright, or if the acid be poured in too quickly, a burnt and unreliable test is likely to be caused. Now gently whirl the sample, giving the bottle a circular and at the same time up and down motion, in order to mix the contents of the bottle without shaking any out of the top, which always remains open. When the contents have been sufficiently mixed by whirling, it should be a uniform dark brick-red color. At this point the bottle will be extremely hot, making it necessary to handle by the neck.



Acid Measure.

Fourth—Now place the sample in one of the pockets of the testing machine, and place a similar one exactly opposite. The machine must *always* be made to *balance.* In case there is only one sample to be tested, a bottle of water may be used for a balance.

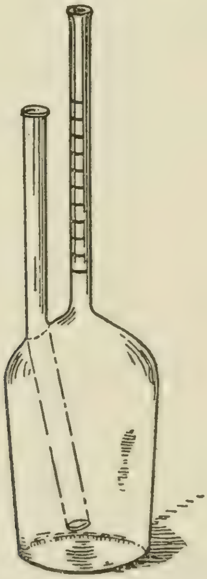
Fifth—Start the machine slowly, gradually increasing the speed until the test bottles are whirling at a rate of 1,000 to 1,200 revolutions per minute. (By counting the number of revolutions made by the pockets for each turn of the crank it can be easily calculated how many turns of the crank will be necessary to achieve the required speed.) Turn steadily for five minutes, then *gently* stop the machine, and with the pipette carefully, in order that no bottle be run over, add clean, soft hot water into the test bottle until the water and fat rise two-thirds of the way up the neck of the bottle, then close the lid, and whirl as before for a period of two minutes. Now the test is made, and simply requires reading.



Showing how to read the test. Spread the dividers from the extreme bottom to the extreme top of the fat, then place the lower point at O and read the number at the top point. 4.6 fat in this case.

Sixth—With a sample compass or dividers measure the fat in the neck of the test bottle, as shown in figure 23. The points of the compass should extend from the very bottom to the very top of the fat, as shown in the cut. Read the fat while hot, or if it gets cool warm it up to about 130 or 135 Fahr. before reading. Do not count out anything for the little cup or maniscus on the top of the fat, Being careful not to change the spread of the compass, place one point at zero and read the figure indicated. A quantity of fat which would extend from zero to one, or from one to two, would be one per cent. A quantity of fat which would make a column extending from zero to four would be four per cent. Notice the fine divisions on the test bottle. There being five marks for each per cent., all divisions between, then, must indicate two-tenths of a per cent. For illustration, suppose the milk tested 4.6 per cent. (as in figure 23), this means simply that there are 4.6 pounds of fat in 100 pounds of this milk. Example: How many pounds of butter fat are there in 473 pounds of milk, which tests 4.6 per cent? This will read, 473 times .046 equals 21.758. There are then 21.758 pounds of butter fat in that quantity of milk. Example: How many pounds of butter fat in 237 pounds of milk testing 3.5 per cent? This reads, 237 times .035 equals 8.295. There are then 8.295 pounds of butter fat in 237 pounds of milk testing 3½ per cent. Example: How many pounds of butter fat in 193 pounds of milk which tests 3.8 per cent?

Skim Milk—First—Make sure that the bottles and pipette are thoroughly clean. If the pipette has been used in testing whole milk or cream it must be well washed before sampling skim milk. The mixing of the sample and the process of adding it to the test bottle, figure 24, are the same as described for whole milk.



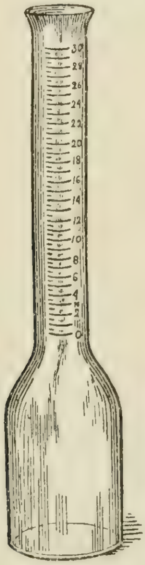
Skim milk test bottle.

Before endeavoring to run the milk down the larger tube of the bottle make sure that there are no drops of water in the slender tube. If there are, the milk will very likely bubble out of the wide-mouth tube, making it necessary to clean the bottle and try again.

Second—The process of whirling, adding hot water and whirling again, are the same as described for whole milk. The same quantity of milk and acid as in former case.

Third—When the second run has been completed, the fat should be read while still hot. The portion of the neck of the bottle, figure 24, between one scratch and another is equal to .05 per cent. A quantity of fat which would extend from the bottom mark to the top would equal half a per cent. A good hand separator will leave in the skim milk about enough fat to fill one space in the neck of this bottle. If, in testing the skim milk, it is found that two spaces are filled with fat, it indicates poor machine or poor handilng.

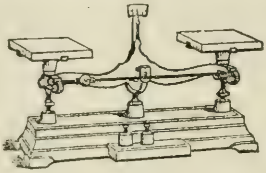
Cream—Although in testing cream the thing accomplished is the same as that accomplished in the testing of milk, the mode of getting the result is somewhat different. Cream is a substance which varies in its richness all the way from 10 per cent. to 60 per cent. fat. Fat is lighter than the milk; therefore, the more fat there is in the cream the lighter that cream is. The whole Babcock test is based on the understanding that 18 grams of the sample be taken. While testing whole milk and skim milk the



Cream test bottle.
]

sample taken may be measured, because they are so nearly constant in weight. The pipette for milk, which holds 17.6 cubic centimeters up to the scratch, holds 18 grams of milk or skim milk, but would not hold 18 grams of cream, and the richer the cream the farther below 18 grams. The sample of cream to be tested, must then be weighed. The process is as follows:

First—Place the cream bottle, figure 25, on one pan of the scales, figure 26, and balance the bottle by sliding those brass balls forward or back. When the balance is perfect, set the 9 gram weight on the opposite pan, then with the pipette drop cream, which has previously been thoroughly mixed, into the test bottle until the balance is again perfect, even down to the drop of cream.



Cream Scale.

Second—Now add about half a tablespoonful of clean, soft water to the cream in the bottle.

Third—Now add the sulphuric acid, using about three-fourths of a measure.

Fourth—Thoroughly mix the acid and cream by the whirling motion as described for milk.

Fifth—Place test bottles in machine, balance and whirl five minutes, then add hot water nearly to top of neck, and whirl two minutes.

Sixth—With the same compass shown in figure 23 read the column of fat in cream. Now suppose the column of fat extended over 13½ spaces, the test of that cream would be 27 per cent. Remember 9 grams only, not 18, of cream were taken. With half the required quantity of cream the result obtained must be doubled. If the cream column extended 22 spaces the true reading would be 44 per cent. Example: How many pounds of fat in 78 pounds of cream which tests 36 per cent? Seventy-eight times .36 equals 28.08. We have then 28.08 pounds of fat in 78 pounds of cream testing 36 per cent. Example: How many pounds of fat in 59 pounds of cream testing 32 per cent? Fifty-nine times .32 equals 18.88. We have then 18.88 pounds of fat in 59 pounds of cream testing 32 per cent. Example: How many pounds of fat in 11 pounds of cream testing 45 per cent?

Cleaning the Glassware—Just as soon as the test is made and the fat read, empty the test bottle, for then, by shaking a little, the ash or lime in the bottom of the bottle will rinse out easily. The hot liquid will also wash out most of the fat.

Caution—Do not dump this where any animal can walk in it, neither put it in a metal or wooden dish. The acid is very strong. Don't let acid get on clothes; it will ruin them in a few minutes.

Wash the glassware in hot water, best with some sal soda or strong soap in it. Rinse in clean water, and turn in a rack to drain and to wait for next time of using.

ERRORS TO AVOID IN TESTING CREAM.

It is not an especially difficult task to test cream, but must be understood, or errors will be made by those of the best intentions. The following are the chief causes of inaccuracy:

1st. Gross sample not a true one, because
  (a) Cream sour and clotted.
  (b) Cream dried on surface.
  (c) Cream partly churned.
  (d) Cream good, but not well mixed before sampling.
2nd. Test bottle sample not correct, because
  (a) Cream measured instead of weighed. (18 grams required.)
  (b) Cream weighed with inaccurate scales. (Keep all bearings free from rust and gum.)
  (c) Of slovenly work in weighing.
3rd. Acid mistakes—
  (a) Too much or too strong acid (burns fat).
  (b) Too little or too weak acid (leaves white curd under the fat).
  (c) Acid too warm (burns fat; 60 to 65 degrees F. works best).
  (d) Acid poured through cream (burns in clots).
  (e) Acid not well mixed when shaking is commenced (burns in clots).
4th. Mistakes in whirling—
  (a) Speed too slow (12-inch tester requires 1,200 revolutions; 24-inch tester requires 800 revolutions).
  (b) Not turned long enough (5 to 6 minutes necessary).
  (c) Bottles too cool while turning (fat cannot rise; should be 140 degrees F. for cream and 200 F. for skim milk).

5th. Mistakes in adding water—
  (a) Water too cold (150 to 200 degrees F. right).
  (b) Water dirty (causes gray cloud below fat).
  (c) Water hard (the lime in hard water often causes unreliable results; use rainwater or condensed steam).

6th. Mistakes in reading fat—
  (a) Reading too hot (fat expanded; 120 to 140 degrees F. right).
  (b) Reading too cold (fat contracted, not volume enough).
  (c) Upper surface of fat not leveled (a few drops of amylic alcohol on top of fat makes a flat surface of the concave one. This applies to cream only.)

7th. Inaccurate graduation of test bottles—
  (a) Every bottle should be tested.

When so small a quantity of cream has to represent so large a quantity it is exceedingly important that every step in the process be performed with the utmost care.

VARIATIONS IN TESTS OF CREAM.

"Why do different lots of cream from the same separator vary so much in per cent. of fat?" This is a very common question asked at Farmers' Institutes all over the State. There are several causes for this variation.

1. Speed of the separator—

The faster the bowl turns the richer the cream, slower the thinner. Sometimes the man does the turning, then again a weaker person, the woman or a child, has the work to do. Sometimes the one turning feels lazy, and at other times is physically excited. Time the machine with the watch.

2. Rate of inflow of the milk—

The faster the milk goes in, the thinner the cream. If the milk hopper is kept full all the time, the extra pressure carries the milk through faster than when it is low in the can. If machine runs empty a few times during the separation, the cream will be richer.

3. Per cent of fat in the milk—

A richer milk gives a richer cream. The milk of a whole herd of cows may vary as much as a half of a per cent. between morning and night. The heat and excitement of the day tends to increase the per cent. of fat present. Any unusual excitement may cause a similar temporary rise in fat.

4. Temperature of the milk when separated—

Any decrease in the size of the hole, out of which the cream is delivered from the bowl, will increase the per cent. of the fat in the cream. Cold cream sometimes thus clogs the passage and causes a richer cream to be delivered.

5. Acidity of the milk—

A half-sour milk may cause a thin cream. If night's milk is left to be separated in the morning in the summer, it very often sours to that extent that when separated the fine clots and fibres of curd cling to the outer wall of the bowl and clog the exit of the skim milk, thus forcing some of it into the cream spout, and in consequence a thin cream is secured.

6. Adjustment of cream screw—

This may have jarred or been turned by some one without the knowledge of the one complaining.

7. Cream will rise on cream—

And if the top be poured off to make butter for the home, the portion sold is thinner than the average. This is occasionally done knowingly by the farmer to test the man who tests the cream.

8. Hand skimmed cream is very variable—

Thick from pans and crocks, and thin from deep cans. It is almost next to impossible to so skim that the same amount of skim milk will be put into the cream vessel each time. The best test for a market cream is thirty-five to forty-five per cent.

The man who does public testing must know his business, and then have enough confidence in himself and enough natural sand to stand by his figures, no matter what they read.

MORE BUTTER THAN BUTTER FAT.

Another frequent query is regarding the amount of butter a given amount of cream will make. The test gotten at the creamery is for butter fat, not for butter. Butter is not all fat. It contains from 10 to 15 per cent. water, from 2 to 3 per cent. salt and from 1 to 2 per cent. casein, or cheesy matter. In general, 6 pounds of fat will make 7 pounds of butter, but whether it does that or not will depend on

1. Acidity of cream when churned—

If cream is not sour enough, fat may be lost in the buttermilk, and thus lessen the overrun.

2. Temperature of cream when churned—

If too warm, the amount of fat lost in the buttermilk will be great, and the yield lowered.

3. Amount the butter is worked—

If worked much the water may be worked out and the butter left dry, or with only 10 per cent. of water, while less working or working in water may leave a wet butter, or one containing as high as 20 per cent. water.

4. Size of churn and amount of cream—

If the churn is too large for the amount of cream, considerable cream may be lost by sticking to axis of the churn. This is especially liable to occur with thick cream in small quantities.

5. Accuracy of the scales—

On small amounts of butter the degree of accuracy of the scales used may introduce an apparent discrepancy.

THE ADULTERATION OF MILK AND ITS DETECTION.*

Composition of Milk—Before entering into a discussion of the adulteration of an article, it is necessary that the normal composition of that article be first understood. Milk is a complex fluid, made up of several very dissimilar substances. Its composition varies according to the breed of the animal. Some breeds of cows give milk much richer in fat and samewhat richer in other solids than others. Not only is there a difference between breeds, but the milk from different individuals of the same breed will vary considrably, and a cow giving milk which tests 4 per cent. fat, when she is fresh, will usually give milk testing 4½ per cent. to 4.8 per cent. toward the end of her lactation period. When cows are nearly dry their milk is richer in all solids, especially in fat, than it is when they are fresh. Dry feed also has a tendency to produce a slightly richer milk.

Milk Solids—When milk is evaporated to dryness the water is evaporated, and the milk solids are obtained. Milk solids are a mechanical mixture of fat, casein, albumen, milk, sugar and ash. Normal milk contains about 13 per cent. of solid matter and 87 per cent. water. Some samples contain as low as 12 per cent. solids, with 88 per cent. water; others as high as 14 per cent. solids, with 86 per cent. water.

Milk Fats—Average milk contains about 3½ per cent. of fat. Some normal samples may contain 3 per cent. or less, while others may contain 6 per cent. or more. The fat in milk is not present in solution, but in suspension in the form of minute globules. These milk fat globules are about 1/5,000 of an inch in diameter.

(*In preparing the following pages on adulteration free use has been made of "Dairy Chemistry" by H. Snyder.)

A single drop of milk contains from one hundred million to one hundred and fifty million fat globules. The size of the fat globules varies, first, with the breed and individuality of the animal, and second, according to the length of time the animal has been in milk. When a cow is fresh there is a smaller number of globules, but the globules are larger. When the cow is well along in her milking period the globules are smaller, but more numerous. The fat is lighter than any other constituent of the milk.

Casein—Average milk contains about 3 per cent. of casein, which in fresh milk is practically in a soluble condition, but in sour milk is precipitated as curd. The per cent. of casein in milk is quite constant, ranging from 2.8 to 3.5. As a general rule normal milk contains less casein than fat.

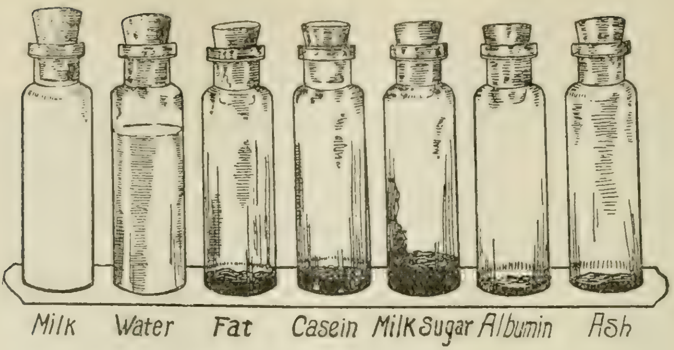
Albumen—Average milk contains about one-half a per cent. of albumen, which is nearly identical with egg albumen, or the white of the egg. When fresh milk is boiled the "scum" which forms on the surface is albumen. The amount of albumen in milk is quite constant, and ranges from one-half to three-fourths of a per cent.

Milk Sugar—Lactose, or milk sugar, is present in milk to the extent of about 5 per cent. When obtained in the pure state it resembles in appearance confectionary sugar, but not in taste. Milk sugar takes an important part in butter and cheese-making, as it is the material from which the acid is formed when milk sours. The amount of milk sugar or lactose in milk is quite constant, ranging from 4.6 to 5.4 per cent. In average milk it is the constituent which is present in largest amount of any of the milk solids.

Ash—When the milk solids are burned there is a small amount of greyish, white ash obtained. The ash content of milk is constant and varies but little from three-fourths of one per cent. The white substance, which settles at the bottom of the Babcock test bottles when testing, is ash.

AVERAGE MILK HAS ABOUT THE FOLLOWING COMPOSITION.

	Ave. per cent.	Range per cent.
Water	87.00	82.4 to 89.6
Fat	3.50	2.5 to 6.0
Milk sugar	5.00	4.3 to 6.0
Casein	3.25	2.5 to 4.0
Albumen	0.50	0.5 to 0.8
Ash	0.75	0.6 to 0.8



Showing composition of milk.

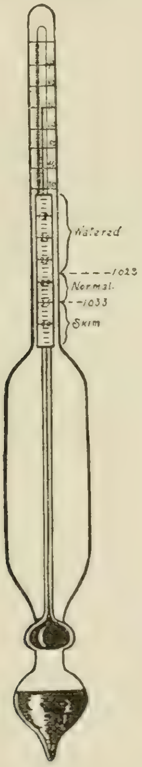
It is seldom that the extreme limits as given above are met with. See figure 27 for comparative composition of average milk.

FORE-MILK VS. STRIPPINGS.

The fore-milk, or that obtained with the first stream or two taken from the cow, is usually very poor in butter fat. The last few streams are rich in fat. The writer has tested this point with different cows, and has found that in some cases the strippings tested as high as seventeen times richer than the first, although usually the difference is only about three to four times. Thus the necessity for thorough milking of the cow before taking a sample to test.

THE SPECIFIC GRAVITY OF MILK.

If a can holds 100 pounds of water, to fill it with milk would require about 103.2 pounds. This is because milk has a greater specific gravity than water. By a specific gravity of a material, is meant the weight of a given volume compared with the weight of an equal volume of water under the same conditions. Milk has a higher specific gravity than water, because it contains in solution a number of substances, as sugar, ash, casein and albumen, which increase the weight of an equal volume of milk, causing it to have a higher specific gravity. The fat of milk, on the other hand, which is lighter than water, has a tendency to lower the specific gravity. Since the variations in the fat content of milk range between three and six per cent., it follows that the variations in the gravity of milk are due largely to the variations in the fat content. Since the milk fats vary between known limits, the specific gravity of normal milk varies between definite limits. The lowest specific gravity of normal milk is 1.029, while the highest specific gravity is 1.034. The richer a sample of milk in casein, milk sugar and ash, the greater its buoyant power and the higher specific gravity, which results in the lactometer stem not sinking to so great a depth as it would if less casein, sugar and ash were present. Hence, we find skim milk having a greater specific gravity than normal milk. On the other hand, the addition of water to milk lowers the specific gravity below 1.029, almost proportionally with the amount of water added. Milks very rich in fat have a lower specific gravity than milks which contain less fat. This is due to the additional fat in the milk lowering its specific gravity. A skilled operator can readily determine whether the increase or decrease in the specific gravity of milk is due to variation in the water or in the fat content of the milk.



The Lactometer.

QUEVENNE'S LACTOMETER.

The lactometer is a piece of apparatus for determining the specific gravity of milk. It consists of a bulb (see Fig. 28.) weighted with mercury, attached to a glass tube of cylindrical form provided with a graduated stem, which enables the operator to determine the depth to which the instrument sinks in milk. Numbers registered on the lactometer scale range from 15 to 40. These are called the lactometer degrees. If the lactometer sinks to a depth of 31 on the scale, it means that the milk has a specific gravity of 1.031. In normal milk the lactometer shows a specific gravity of 1.029 to 1.034. Between each of the numbered divisions, as 25 to 30, there are five subdivisions, which enable the operator to read to a .001 on the specific gravity scale, or less, if care is taken in the observations.

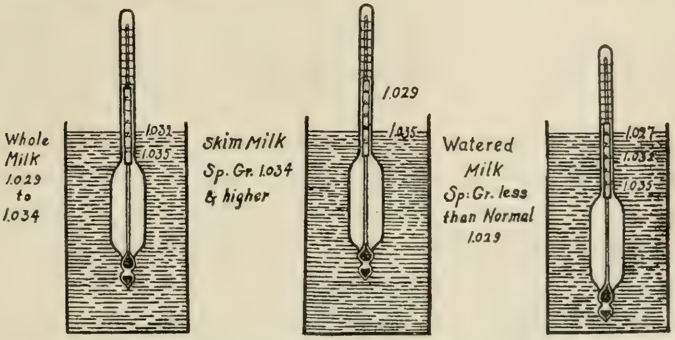
There are other forms of lactometers in use, but the Quevenne's is generally preferred because of its greater accuracy. A lactometer should always be provided with a thermometer, in order that the necessary corrections for temperature of the lactometer readings may be made.

INFLUENCE OF TEMPERATURE.

Whenever a lactometer reading is made, the temperature of the milk should also be recorded, because a variation of 10 degrees in temperature affects the lactometer reading to the extent of 1 degree. When the milk is cold, it is contracted in volume, and the lactometer does not sink to as great a depth as if the milk were warm. This results in the lactometer recording a high specific gravity. On the other hand, if the milk is too warm, it is expanded, which has the effect of diluting the milk, causing the lactometer to sink to a greater depth and a lower specific gravity to be secured. In making corrections for temperature, the following general rule can be applied: When the temperature is greater than 60° F., add .1 of a lactometer degree for each degree of temperature, and when less than 60° F., substract .1 for each lactometer degree. This general rule will apply only for a variation of 10 degrees either above or below the temperature of 60°.

INFLUENCE OF SKIMMING AND WATERING.

Since milk has a specific gravity vorying from 1.029 to 1.034, it follows, as previously stated, that any addition of water necessarily lowers the specific gravity, and any removal of the fats necessarily raises the specific gravity. When skimming alone or watering has been practiced, it is easily detected by means of the lactometer; but when milk is both skimmed and watered, the lactometer results fail to reveal the fact. The water lowers the gravity. and the removal of the fat raises it, so that milk that has been both skimmed and watered, may have the same gravity as normal milk. This double fraud, however, is easily detected when the Babcock test is used jointly with the lactometer.



Showing position of lactometer in normal, skimmed and watered milk.

JOINT USE OF LACTOMETER AND BABCOCK TEST.

When used jointly, the quality of the milk, and the extent to which any adulteration may have been practiced, can be accurately determined. The following general rule will aid in determining the quality of milk: A low fat and a high specific gravity indicate skimming or removal of fats. A low fat and a low specific gravity indicate the addition of water. A low fat and a normal specific gravity indicate that milk has been both skimmed and watered. While, if there is a normal fat and a normal gravity, it safe to conclude that the milk has been neither skimmed nor watered.

IF THE ANALYSIS OF SUSPECTED SAMPLE SHOW

Specific Gravity of milk	low	watered
Fat	low	
Specific Gravity of milk	high	skimmed
Fat	low	
Specific Gravity of milk	normal	skimmed and watered.
Fat	low	

Any one, after a little experimenting on his own account, can soon learn to detect the common adulterations of milk.

PRESERVATIVES.

When milk or cream handled in the ordinary way around town and left warm does not become sour in 36 hours some preserving agent has almost certainly been used. There is no preservative yet known which will keep the milk sweet without injuring it as food. Milk is a delicate food, intended for the delicate stomach of an infant, and the continued use of small quantities of preservatives may, and doubtless does, often mean the slow killing of the child consuming that milk. When milk is produced from healthy cows and in a cleanly manner and kept cool, there will be no need for chemical preservatives. The slovenly and indifferent man is the one who makes use of preservatives to cover up his poor work. The dairyman who makes a practice of adding chemical preservatives to milk intended for consumption in homes may not be a murderer, but he is by the very act, acknowledging that he is willing to take chances on becoming one.

MISSOURI CROP REVIEW FOR 1906.

The spring of 1906 opened up very unfavorably for crops. The winter was very open, and on account of light freezing the soil was in poor condition for plowing. On the first of April, 1905, 79 per cent. of the oats was sown and one-fourth of the corn land plowed, while on the same date this year only 4 per cent. of the oat crop was sown and not a furrow was plowed for corn. On account of a lack of snow covering, fall seeding of timothy and young clover was badly damaged. In some of the southern counties it was damaged to the extent of 35 to 65 per cent. of the entire crop. Excessive rains during the fall of 1905, continuing through the winter, caused much damage to hay, and live stock wintered poorly, and in some places considerable loss occurred in the early spring. By the month of May a drought had set in, in many counties in the State, and in some sections continued through almost the entire year. The section suffering most from this cause was a strip across the State from Cameron on the west to Hannibal on the east. In some localities not more than an inch and a half of rain fell during the crop growing season, and it was thought that with this small amount of water an average crop could not be produced; yet many farmers, taking advantage of their present knowledge of conserving soil moisture, produced a full average crop of corn; however, the total yield for that section was somewhat below the average. The drought caused great damage to oats and hay, the hay crop being the lightest for many years and the oat crop being lighter than any year since the drought of 1901. The drought, however, did not materially affect the wheat crop. In both yield and quality the wheat crop was the best since the banner crop of 1902.

As a rule, farm prices for grains and live stock have been good, and the net returns of the farmers for the year have been above the average.

The following tables give detailed information concerning the yield of the leading crops of the State:

CORN, HAY AND FORAGE.

Table giving acreage, average yield per acre and total product of corn and hay and forage, by counties, for the year 1906:

	Corn.			Hay and forage.	
	Acres planted..	Average yield per acre, bu..	Total yield per county, bu...	Acres........	Total yield per county, tons.
State........................	6,983,335	33.4	233,209,625	3,288,111	2,201,577
County.					
Adair........................	64,535	35	2,258,725	66,645	33,322
Audrain......................	123,491	28	3,457,750	57,946	34,767
Andrew.......................	90,244	35	3,158,540	30,470	21,329
Atchison.....................	168,425	44	7,410,700	17,880	17,880
Barry........................	51,929	33	1,713,655	13,950	13,950
Barton.......................	95,755	28	2,681,140	29,760	23,808
Bates........................	146,105	32	4,675,360	67,600	67,600
Benton.......................	56,551	31	1,753,080	27,100	21,680
Bollinger....................	32,296	31	1,001,175	11,325	9,060
Boone........................	84,108	34	2,859,670	48,700	29,220
Buchanan.....................	66,054	38	2,510,050	20,600	14,420
Butler.......................	22,385	35	783,475	6,600	6,600
Caldwell.....................	83,459	25	2,086,475	45,060	18,024
Callaway.....................	82,575	34	2,807,550	51,440	25,720
Camden.......................	30,780	35	1,077,300	11,400	6,840
Cape Girardeau...............	33,426	38	1,270,190	20,540	20,540
Carroll......................	142,614	29	4,135,805	49,080	24,540
Carter.......................	10,217	30	306,510	2,320	1,392
Cass.........................	105,107	35	3,678,745	61,150	42,805
Cedar........................	53,111	29	1,540,220	18,400	16,560
Chariton.....................	73,953	32	2,366,495	55,600	27,800
Christian....................	43,430	33	1,433,190	13,780	11,024
Clark........................	91,634	35	3,207,190	47,880	23,940
Clay.........................	70,191	33	2,316,305	20,465	10,232
Clinton......................	96,324	36	3,467,665	37,040	14,816
Cole.........................	23,484	37	868,910	17,300	13,840
Cooper.......................	75,847	39	2,958,035	24,620	17,234
Crawford.....................	28,337	33	935,120	13,000	13,000
Dade.........................	64,484	30	1,934,520	17,000	15,300
Dallas.......................	45,655	30	1,369,650	19,200	15,360
Daviess......................	102,542	29	2,973,720	56,415	22,566
DeKalb.......................	97,460	31	3,021,260	41,635	20,817
Dent.........................	31,401	31	973,430	16,130	12,904
Douglas......................	39,494	30	1,184,820	13,250	10,600
Dunklin......................	43,085	30	1,292,550	5,000	5,000
Franklin.....................	48,319	40	1,932,760	24,000	19,200

CORN, HAY AND FORAGE—Continued.

County.	Corn.			Hay and forage.	
	Acres planted.	Average yield per acre, bu..	Total yield per county, bu..	Acres........	Total yield per county, tons.
Gasconade	22,318	40	892,720	12,460	8,722
Gentry	88,847	35	3,109,645	52,495	31,497
Greene	77,836	34	2,646,425	26,400	26,400
Grundy	74,567	33	2,460,710	55,460	22,184
Harrison	124,828	35	4,368,980	80,255	40,127
Henry	110,205	32	3,526,560	45,430	40,887
Hickory	35,715	29	1,035,735	16,200	12,960
Holt	95,515	38	3,629,570	11,375	11,375
Howard	45,555	38	1,731,090	27,240	16,344
Howell	41,677	25	1,041,925	13,000	10,400
Iron	13,210	30	396,300	8,700	8,700
Jackson	100,482	38	3,818,315	42,175	33,740
Jasper	72,667	34	2,470,680	18,170	18,170
Jefferson	41,740	36	1,502,640	20,140	18,126
Johnson	102,708	40	4,108,320	54,970	54,970
Knox	60,073	28	1,682,045	58,460	29,230
Laclede	34,357	32	1,099,425	24,100	19,280
Lafayette	114,435	42	4,806,270	35,070	28,056
Lawrence	59,781	35	2,092,335	13,060	13,060
Lewis	52,847	30	1,585,410	48,188	24,094
Lincoln	68,405	29	1,983,745	20,978	18,880
Linn	80,090	32	2,562,880	81,928	40,964
Livingston	91,865	29	2,664,085	50,650	20,260
McDonald	27,195	32	870,240	8,700	7,830
Macon	82,161	28	2,300,510	82,520	33,008
Madison	15,290	30	477,600	10,780	8,624
Maries	26,904	28	753,310	12,200	9,760
Marion	50,695	28	1,419,460	29,989	17,993
Mercer	62,944	30	1,888,320	58,630	29,315
Miller	32,923	35	1,152,305	16,630	9,978
Mississippi	39,051	40	1,562,040	4,470	4,470
Moniteau	41,944	36	1,509,985	25,500	17,850
Monroe	92,065	29	2,669,885	54,160	27,080
Montgomery	72,333	30	2,169,990	27,580	13,790
Morgan	37,455	30	1,123,650	23,520	16,464
New Madrid	39,278	35	1,374,730	2,610	2,610
Newton	42,410	32	1,357,120	11,000	11,000
Nodaway	236,173	38	8,974,575	56,500	50,850
Oregon	26,054	30	781,620	5,170	4,136
Osage	28,840	37	1,067,080	14,250	11,400
Ozark	30,875	25	771,875	3,670	2,936
Pemiscot	19,329	35	676,515	960	960
Perry	25,980	36	935,280	11,224	11,224
Pettis	98,035	38	3,725,330	45,163	31,614

CORN, HAY AND FORAGE—Continued.

County.	Corn.			Hay and forage.	
	Acres planted.	Average yield per acre, bu.	Total yield per county, bu..	Acres.......	Total yield per county, tons.
Phelps	27,592	30	827,760	16,130	12,904
Pike	76,322	29	2,213,340	41,725	37,552
Platte	56,703	42	2,381,525	15,000	10,500
Polk	70,895	31	2,197,745	29,540	23,632
Pulaski	28,060	32	897,920	11,800	8,260
Putnam	60,244	31	1,867,565	67,760	33,880
Ralls	63,510	31	1,968,810	32,000	19,200
Randolph	54,873	31	1,701,065	21,650	10,825
Ray	117,351	30	3,520,530	43,760	21,880
Reynolds	13,685	28	383,180	8,730	6,984
Ripley	23,527	35	823,445	4,580	3,664
Saline	157,450	41	6,455,450	36,100	25,270
Schuyler	37,271	33	1,229,945	37,000	18,500
Scotland	58,074	33	1,916,440	51,430	25,715
Scott	35,460	38	1,347,480	7,240	7,240
Shannon	21,418	28	599,705	5,330	3,731
Shelby	69,778	32	2,232,895	53,865	21,546
Stoddard	51,553	30	1,546,590	8,050	8,050
Stone	30,463	30	913,890	7,525	6,020
St. Charles	42,302	50	2,115,100	16,800	16,800
St. Clair	70,110	31	2,173,410	30,540	27,486
St. Francois	18,715	30	561,450	15,140	15,140
Ste. Genevieve	15,236	32	487,550	9,230	9,230
St. Louis	39,163	40	1,566,520	32,060	32,060
Sullivan	67,622	30	2,028,660	94,200	56,520
Taney	27,280	30	818,400	3,545	2,836
Texas	47,514	24	1,140,335	25,200	20,160
Vernon	142,035	32	4,545,120	58,770	58,770
Warren	25,612	38	973,555	10,130	10,130
Washington	25,603	33	844,900	12,340	12,340
Wayne	26,225	28	734,300	10,860	8,688
Webster	39,283	33	1,296,340	21,630	17,304
Worth	52,076	35	1,822,660	26,040	18,228
Wright	33,236	30	997,080	19,400	15,520

WHEAT AND OATS.

Table giving acreage, average yield per acre, and total product of wheat and oats, by counties for the year 1906:

	Wheat.			Oats.		
	Acreage......	Average yield per acre, bu.	Total yield per county, bu..	Acreage......	Average yield per acre, bu.	Total yield per county, bu..
State........................	2,266,799	15.8	34,799,169	651,689	21.1	14,129,437
County.						
Adair........................	2,035	14	28,490	3,302	18	59,436
Audrain......................	1,185	12	14,220	21,820	22	480,040
Andrew.......................	5,165	20	103,300	5,517	23	126,891
Atchison.....................	5,850	21.5	125,775	22,995	27	620,865
Barry........................	38,347	15.5	594,378	5,258	20	105,160
Barton.......................	12,425	13.5	167,737	9,760	18	175,680
Bates........................	15,082	15	226,230	14,110	24	338,640
Benton.......................	10,510	13	136,630	7,897	18	142,146
Bollinger....................	23,890	12.5	298,625	4,959	20	99,180
Boone........................	21,615	15	334,922	7,025	21	147,525
Buchanan.....................	33,570	22	738,540	4,203	24	100,872
Butler.......................	1,895	11	20,845	1,373	20	27,460
Caldwell.....................	2,295	18.5	42,457	2,308	18	41,544
Callaway.....................	26,585	15	398,775	10,911	20	218,220
Camden.......................	6,457	11.5	74,255	2,990	21	62,790
Cape Girardeau...............	60,610	13.5	818,235	5,844	20	116,880
Carroll......................	22,195	16.5	366,217	5,700	22	125,400
Carter.......................	1,200	10	12,000	540	20	10,800
Cass.........................	19,125	20	382,500	11,939	25	298,475
Cedar........................	11,191	13	145,483	8,466	20	169,320
Chariton.....................	24,970	17	424,490	3,750	20	75,000
Christian....................	22,160	19	421,040	5,705	22	125,510
Clark........................	7,556	22	166,232	22,875	19	434,625
Clay.........................	8,400	19	159,600	2,038	25	50,950
Clinton......................	3,190	19	60,610	4,654	20	93,080
Cole.........................	30,082	15	451,230	3,785	22	83,270
Cooper.......................	52,142	14	729,988	7,151	22	157,322
Crawford.....................	15,630	10	156,300	2,246	24	53,904
Dade.........................	26,895	15	403,425	9,984	20	199,680
Dallas.......................	8,210	10	82,100	6,306	16	100,896
Daviess......................	5,573	17.5	97,527	2,848	20	56,960
DeKalb.......................	1,785	21	37,485	3,180	19	60,420
Dent.........................	12,625	8	101,000	2,000	15	30,000
Douglas......................	15,340	11	168,740	3,320	20	66,400
Dunklin......................	4,083	17.5	71,452	884	25	22,100
Franklin.....................	78,189	15	1,172,835	6,827	25	170,675

WHEAT AND OATS—Continued.

County.	Wheat.			Oats.		
	Acreage.....	Average yield per acre, bu..	Total yield per county, bu..	Acreage.....	Average yield per acre, bu.	Total yield per county, bu..
Gasconade	36,069	13	468,897	4,575	23	105,225
Gentry	1,420	20	28,400	5,499	23	126,477
Greene	42,995	15	644,925	11,740	23	270,022
Grundy	2,905	23	66,815	2,435	30	73,050
Harrison	2,240	15	33,600	7,619	25	190,475
Henry	23,820	14	333,480	13,723	18	247,014
Hickory	7,157	12.5	89,462	4,467	18	80,406
Holt	7,381	19.5	143,929	14,328	25	358,200
Howard	42,095	18	757,710	1,804	20	36,080
Howell	18,291	10	182,910	3,184	15	47,760
Iron	2,020	9	18,180	1,053	20	21,060
Jackson	24,280	25	607,000	5,279	20	105,580
Jasper	59,885	17	1,018,054	14,545	25	363,625
Jefferson	27,861	14	390,054	2,192	18	39,456
Johnson	48,407	20	968,140	8,237	23	189,451
Knox	2,035	14	28,490	4,140	16	66,240
Laclede	8,825	10	88,250	4,174	18	75,132
Lafayttee	50,130	22	1,102,860	11,543	25	288,575
Lawrence	68,620	17.5	1,200,850	13,473	25	336,825
Lewis	5,990	20	119,800	5,436	16	86,976
Lincoln	44,436	18.5	822,066	10,931	25	273,275
Linn	3,880	18	69,840	3,163	22	69,586
Livingston	6,744	18	121,392	3,533	22	77,726
McDonald	15,630	11	171,930	2,050	21	43,050
Macon	5,430	13	70,590	2,597	19	49,343
Madison	8,360	14	117,040	1,076	19	20,444
Maries	13,732	10	137,320	2,727	20	54,540
Marion	16,834	23	387,182	2,929	16	46,864
Mercer	1,565	16	25,040	4,470	25	111,750
Miller	14,543	12.5	181,787	3,885	25	97,125
Mississippi	36,505	17	620,585	140	25	3,500
Moniteau	28,644	11	315,084	7,884	19	149,796
Monroe	8,707	18	156,726	8,404	22	188,888
Montgomery	18,366	15	275,490	14,666	21	307,986
Morgan	11,892	13	154,596	5,865	18	105,570
New Madrid	16,850	18	303,300	266	25	6,650
Newton	42,193	15	632,895	6,850	22	150,700
Nodaway	5,820	18.5	107,670	21,828	25	545,700
Oregon	12,890	7	90,230	2,368	17	40,256
Osage	36,598	15.5	567,269	2,265	20	45,300
Ozark	7,875	8	63,000	1,634	22	35,948
Pemiscot	5,495	18	98,910	62	25	1,550
Perry	53,052	16.5	875,358	4,698	25	117,450
Pettis	22,350	14	312,900	6,902	20	138,040

WHEAT AND OATS—Cotninued.

County.	Wheat.			Oats.		
	Acreage	Average yield per acre, bu.	Total yield per county, bu.	Acreage	Average yield per acre, bu.	Total yield per county, bu.
Phelps	10,217	11	112,387	3,905	18	70,290
Pike	46,157	19.5	900,061	12,113	20	242,260
Platte	39,850	22.5	896,625	2,631	25	65,775
Polk	21,143	13	274,859	10,996	18	197,928
Pulaski	7,158	10	71,580	2,066	18	37,188
Putnam	1,501	16	24,016	5,430	24	130,320
Ralls	11,553	22	254,166	5,584	22	122,848
Randolph	3,070	16	49,120	2,441	23	56,143
Ray	12,865	24	308,765	1,995	20	39,900
Reynolds	2,205	8	17,640	790	18	14,220
Ripley	5,260	11	57,860	3,290	20	65,800
St. Charles	69,378	21	1,456,938	7,344	30	220,320
St. Clair	7,905	13	102,765	8,903	18	160,254
Ste. Genevieve	32,771	14.5	475,179	1,268	18	22,824
St. Francois	15,656	12	187,872	1,528	18	27,504
St. Louis	52,860	14	740,040	2,478	24	59,472
Saline	54,700	19	1,039,300	5,933	20	118,660
Schuyler	2,815	20	56,300	4,573	23	105,179
Scotland	1,360	16	21,760	9,714	20	194,280
Scott	55,905	17	950,385	232	20	4,640
Shannon	2,907	8	23,256	915	15	13,725
Shelby	13,736	14	192,304	6,622	15	99,330
Stoddard	26,481	14	370,734	1,940	20	38,800
Stone	8,883	14	124,362	1,485	21	31,185
Sullivan	835	17.5	14,612	2,657	30	79,710
Taney	6,736	10	67,360	1,733	22	38,126
Texas	19,018	8	152,144	3,316	15	49,740
Vernon	12,088	13	157,144	11,130	20	222,600
Warren	23,796	17	404,532	7,058	30	211,740
Washington	16,630	13.5	224,505	2,199	24	52,776
Wayne	7,286	10	72,860	1,404	20	28,080
Webster	19,505	10	195,050	6,377	20	127,540
Worth	1,080	20	21,600	3,380	25	84,500
Wright	12,910	10	129,100	3,150	20	63,000

SUMMARY OF THE ACREAGE YIELD AND VALUE OF FARM CROPS FOR THE YEAR 1906 FOR THE STATE AND BY SECTIONS.

CORN.

Section.	Acres planted.	Average yield per acre, bu.	Total yield bushels.	Total value.
Northeast	1,339,064	31.3	41,843,900	$15,952,989
Northwest	2,133,099	35	74,525,705	27,445,159
Central	1,122,656	34.9	39,140,795	14,722,251
Southwest	1,536,394	32.2	49,527,190	16,119,575
Southeast	852,122	33	28,172,035	11,077,225
State	6,983,335	33.4	233,209,625	$85,317,199

WHEAT.

Section.	Acres sown.	Acres harvested.	Average yield per acre, bu.	Total yield bushels.	Total value.
Northeast	297,920	287,585	18.8	5,413,145	$3,707,973
Northwest	245,265	245,868	21.4	5,264,202	3,410,700
Central	451,355	441,572	14.7	6,509,155	4,235,326
Southwest	580,895	559,360	15.9	8,593,436	5,365,733
Southeast	663,975	652,494	13.8	9,019,231	6,178,447
State	2,239,410	2,266,799	15.8	34,799,169	$22,898,179

WHEAT SOWN, FALL 1906.

Section.	Acreage sown, 1906.	Acreage compared with previous year, %	Average condition crop, Dec. 1, 1906.	Previous five-year average con. Dec. 1, 1906.
Northeast	300,787	100	82	89
Northwest	254,979	104	75	92
Central	465,721	103	86	86
Southwest	602,657	103	82	84
Southeast	657,813	99	85	86
State	2,281,957	102	82	87

OATS.

Section.	Acres harvested.	Average yield per acre, bu.	Total yield, bushels.	Total value.
Northeast	161,358	21.5	3,465,246	$1,104,553
Northwest	137,983	23	3,344,690	1,042,301
Central	104,133	20	2,051,439	703,758
Southwest	184,568	21	3,956,131	1,173,860
Southeast	63,647	20	1,311,931	470,575
State	651,689	21.1	14,129,437	$4,495,047

HAY AND FORAGE.

Section.	Acres harvested.	Average yield per acre, ton.	Total yield Tons.	Total value.
Northeast	981,184	.6	536,913	$5,660,743
Northwest	846,055	.6	482,637	5,173,393
Central	546,443	.7	360,603	3,620,889
Southwest	587,240	.9	528,468	4,271,854
Southeast	327,189	.9	292,955	3,626,811
State	3,288,111	.7	2,201,577	$22,353,690

PRAIRIE HAY.

Section.	Acres harvested.	Average yield per acre, ton.	Total yield, tons.	Total value.
Northeast	16,709	1	16,709	$130,866
Northwest	33,848	1	33,848	262,777
Central	15,496	1	15,496	113,751
Southwest	99,679	1	99,679	714,950
Southeast	2,213	1	2,213	22,106
State	167,945	1	167,945	$1,244,450

FLAX.

Section.	Acres sown.	Average yield per acre, bu.	Total yield.	Total value.
Northeast	382	9	3,438	$3,094
Northwest	540	10	5,400	5,400
Central	1,370	8	10,960	11,179
Southwest	16,425	7	114,975	102,328
Southeast				
State	18,717	8.5	134,773	$122,001

RYE.

Section.	Acres sown.	Average yield per acre, bu.	Total yield, bushels.	Total value.
Northeast	4,000	14.8	59,200	$33,744
Northwest	7,500	19.5	147,225	85,390
Central	1,850	13.7	25,345	14,953
Southwest	2,300	12	27,600	16,560
Southeast	2,850	13.4	38,190	24,823
State	18,550	14.6	297,560	$175,470

BROOMCORN.

Section.	Acres sown.	Average yield per acre, lbs.	Total yield, lbs.	Total value.
Northeast	465	300	139,500	$4,185
Northwest	450	300	135,000	3,510
Central	550	375	206,250	8,869
Southwest	2,805	350	981,750	35,343
Southeast	150	300	45,000	1,530
State	4,420	325	1,507,500	$53,437

COTTON.

Section.	Acres sown.	Average yield per acre, lbs.	Total yield, lbs.	Total value.
Northeast	....	....	....	....
Northwest	....	....	....	....
Central	....	....	....	....
Southwest	5,997	225	1,349,325	$121,439
Southeast	65,366	307	20,067,362	1,705,726
State	71,363	300	21,416,687	$1,827,165

POTATOES.

Section.	Acreage 1906.	Average yield per acre, bu.	Total yield bushels.	Total value.
Northeast	13,900	71	986,900	$631,616
Northwest	18,950	67	1,269,650	876,058
Central	12,400	101	1,252,400	663,772
Southwest	15,680	92	1,442,560	620,301
Southeast	20,055	89	1,784,895	981,692
State	80,985	84	6,736,405	$3,773,439

TOBACCO.

Section.	Acreage 1906.	Average yield per acre, lbs.	Total yield lbs.	Total value.
Northeast	510	660	336,600	$37,026
Northwest	530	600	318,000	38,160
Central	1,030	697	717,910	86,149
Southwest	465	675	313,875	31,387
Southeast	590	650	383,500	38,350
State	3,125	656	2,069,885	$231,072

SUMMARY OF TOTAL YIELD AND TOTAL VALUE OF FARM CROPS PRODUCED BY MISSOURI FARMERS IN THE YEAR 1906.

	Acreage.	Yield.	Total farm value.
Corn	6,983,335	233,209,625	$85,317,199
Wheat	2,266,799	34,799,169	22,898,179
Oats	651,689	14,129,437	4,495,047
Hay and Forage	3,288,111	2,201,577	22,353,690
Prairie Hay	167,945	188,010	1,244,450
Flax	18,717	134,773	122,001
Rye	18,550	297,550	175,470
Buckwheat	2,450	36,750	35,647
Barley	1,970	43,340	24,270
Broomcorn	4,420	1,507,500	53,437
Cotton	71,363	21,416,687	1,827,165
Potatoes	80,985	6,736,405	3,773,439
Tobacco	3,125	2,443,255	289,995
Sorghum syrup	32,000	3,936,000	1,574,400
Sorghum seed	32,000	768,000	583,680
Clover seed	28,080	56,160	393,120
Timothy and other grass seeds	40,800	150,880	295,045
Kaffir corn, millett, cowpeas castor beans, etc.	....	....	1,000,000
Miscellaneous vegetables	....	....	6,250,000
Total value of all crops	....	....	$152,711,634

CROP YIELDS 1906.

AVERAGE PER ACRE BY CROP SECTIONS.

Crop.	N. E. Sec. 20 counties.	N. W. Sec. 21 counties.	Central 21 counties.	S. W. Sec. 23 counties.	S. E. Sec. 29 counties.	Whole State, 114 counties.
Corn, bushels	31.3	35	34.9	32.2	33	33.4
Wheat, bushels	18.8	21.4	14.7	15.9	13.8	15.8
Oats, bushels	21.5	23	20	21	20	21.1
Hay — Timothy, tons	.6	.6	.7	.9	.9	.7
Hay — Prairie, tons	1	.1	1	1	....	1
Hay — Clover........tons	1	1	1	1	1	1
Hay — Cowpeas	2	2	2	2	2	2
Hay — Alfalfa, tons	3	3	3	2	2	2.6
Flax, bushels	9	10	8	7	....	8.5
Rye, bushels	14.8	19.5	13.7	12	13.4	14.6
Buckwheat, bushels	17	18	18	9	14	15
Barley, bushels	25	19	21	....	26	22.7
Broomcorn, pounds	300	300	375	350	300	325
Cotton (Lint), pounds	....	....	....	225	307	300
Potatoes, bushels	71	67	101	92	89	84
Tobacco, pounds	660	600	697	675	650	656
Sorghum syrup, gallons	100	98	101	87	101	97
Sorghum seed, bushels	33	26	28	25	20	26
Kaffir corn, bushels	30	22	22	30	23	25
Cowpeas, bushels	15	12	15	13	15	14
Clover seed, bushels	2	2	2	2	2	2
Timothy seed, bushels	4	3	4	4	3	3.6

AVERAGE FARM PRICE, NOVEMBER 1, 1906.

The prices given in this table are governed by local conditions and are the current local prices prevailing in the country.

	N. E.	N. W.	Central	S. W.	S. E.	State.
Corn, per bushel	$ .38	$ .37	$ .37	$ .33	$ .40	$ .37
Wheat, per bushel	.69	.64	.66	.63	.68	.66
Oats, per bushel	.32	.32	.34	.29	.36	.32
Flax, per bushel	.90	1.00	1.02	.89	....	.95
Timothy seed, per bushel	1.99	2.00	2.40	2.17	2.50	2.21
Clover seed, per bushel	8.00	7.00	7.00	8.00	7.00	7.00
Cowpea seed, per bushel	1.25	2.00	1.42	1.00	1.30	1.39
Sorghum seed, per bushel	.88	.86	.83	.73	.92	.84
Kaffir corn, per bushel	.50	.51	.59	.56	.47	.53
Rye, per bushel	.57	.58	.59	.60	.65	.60
Buckwheat, per bushel	.77	.71	1.17	1.07	1.15	.97
Barley, per bushel	.52	.47	.52	....	.73	.56
Potatoes, per bushel	.64	.69	.53	.43	.55	.57
Sweet Potatoes, per bu	.91	1.04	.64	.58	.63	.76
Winter apples, per bu	.35	.33	.30	.35	.56	.38
Timothy hay, per ton	11.00	11.00	10.00	8.00	12.00	10.00
Clover hay, per ton	10.00	10.00	10.00	8.00	11.00	10.00
Broom corn, per ton	63.00	53.00	86.00	73.00	....	69.00
Cotton (Lint), per lb	....	....	....	.09	.08	.085
Leaf tobacco, per lb	.11	.12	.12	.10	.13	.116
Wool, per lb	.27	.26	.26	.25	.26	.26

LIVE STOCK—AVERAGE FARM PRICE PER HEAD, DECEMBER 1, 1906.

	N. E. Section.	N. W. Section.	Central Section.	S. W. Section.	S. E. Section.	State.
Horses.						
Spring colts	$51	$49	$48	$48	$43	$48
Yearlings	72	72	66	69	60	68
Two years and over	105	105	94	96	92	98
Mules						
Spring colts	65	68	61	61	53	61
Yearlings	90	95	89	87	77	87
Two years and over	125	135	125	123	113	124
Cattle.						
Steer calves	12	12	12	9	7	10
Heifer calves	9	10	9	7	6	8
Yearling steers	21	21	18	15	11	17
Yearling heifers	16	16	15	12	10	14
Steers, two yrs. and over	32	30	26	23	18	26
Cows, two yrs. and over	29	32	27	26	23	27
Sheep.						
Lambs under one year	4	4.5	4	3.7	3	3.85
All other sheep	5	6	5	4.6	4	4.9
Chickens.						
Average price per pound	.08	.07	.07	.07	.08	.07
Turkeys.						
Average price per pound	.13	.11	.11	.11	.11	.11

LIVE STOCK—CONDITION AS TO THRIFT AND HEALTH, DECEMBER 1, 1906.

	N. E. Section.	N. W. Section.	Central.	S. W. Section.	S. E. Section.	State.
Cattle	95	95	95	95	93	94
Horses	95	97	97	97	97	96
Mules	97	98	98	98	96	97
Hogs	95	90	96	92	88	92
Sheep	94	96	95	95	93	94

ANNUAL REPORT OF DR. D. F. LUCKEY, STATE VETERINARIAN, FOR THE YEAR DEC. 20, 1905, TO DEC. 18, 1906.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Frank Labadie	4461 Swan Av., St. L.	Letter	1906 Jan. 16	1 bay gelding	Glanders	Quarantined.
Murry Phillips & R. A. Dawson	New Madrid, Mo.	Telegram	Jan. 6	200 cattle		All dead.
Murry Phillips & R. A. Dawson	" "	Return visit	Jan 17	"		
Thos. B. Conroy	2543 Madison, St. Louis	Telegram, Dr. Heyd	Jan. 30,	2 horses	Glanders	Quarantined.
Elbert McCubbins	Cross Timbers, Mo.	Telephone message	Feb. 28	5 horses	Strangles	Advised 1 oz. potassium nitrate, twice a day.
H. C. Bass	Springfield, Mo.	Message	Apr. 23	2 hogs; 2 cows	Rabies	Dead.
Charlie Davis	Springfield, Mo.	Message	Apr. 23	7 cows	Aphthous fever	Advised Epsom salts. mouth wash solution bluestone.
C. H. Lanham	1747 S. 18th St. Louis.	Return visit		1 grey gelding	Glanders	Quarantined.
Yuba New	Skidmore, Mo.	Letter, Stock Yards Inspector	May 26	Hogs	Tubercolosis	
Jasper Morrison	Linn Creek, Mo.	Petition	June 10	2 cows	Rabies	Dead.
C. S. Floyd	" " "	"	"	1 cow	"	"
B. F. Aryes	" " "	"	"	1 cow	"	"
Hugh Russell	Zebra, Mo.	"	"	5 hogs	"	"
J. W. Blevins	" "	"	"	2 cows	"	"
Jas. R. Miller	" "	"	"	3 cows	"	"
A. S. Banner	" "	"	"	2 cows	"	"
W. J. Miller	" "	"	"	1 cow	"	"
M. C. Stevens	" "	"	"	1 cow	"	"
W. W Providence	" "	"	"	1 cow	"	"
A. B. Hedwell	Bryans, Mo.	U. S. Inspector	June 19	100 sheep	No disease	
John Twitler	Pilot Grove, Mo.	Message	July 17	1 bull	Rabies	Dead.
John McMahon	1909 Madison st. St. L.	Letter	June 22	1 mule	Glanders	Qaurantined.
Mueller Coal Co.	2500 S. Bismark, St. L.	Telegram	Aug. 3	1 grey mare	"	Killed by owner.
Jerry Watkins	2335 Randolph, St. L.	Telegram, Dr Heyde	Aug. 6	1 bey gelding	Glanders	Quarantined.
H. W. Beck	20th and Pine st St. L.	Telegram, Dr. C. W Crowley	Aug. 28	1 black gelding	"	Killed by owner.
N. P. Gaffney	2218 Adams St. St. L.	Letter	Aug. 30	1 bey gelding	"	Quarantined.
U. H. McLafferty	5422 Magnolia av., St. L.	Post card	Aug. 30	1 sorrel gelding	"	"

Mueller Coal Co.	2500 S. Bismark St., St. L	Personal request	Aug. 31	1 grey mule	"	Killed by owner.
Geo. Bothwell	Nettleton, Mo	Letter, U. S. Ins.	Sept. 5	Hogs	Tuberculosis	Awaited instructions Executive Committee.
Joe Rochman	1235 N. 16th St., St. L.	Letter, Dr. W. F. Heyde	Sept. 9	2 horses	Glanders	Quarantined.
John McCarmac	Huntsville, Mo	Petition	Sept. 15	1 jennet	Nasal gleet	Not worth treating.
W. L. Alexander	Salisbury, Mo	Telegram, Dr. Sherman	Sept. 17	4 cows	Tick fever	Quarantined.
Wm. Winfrey	3019 Clark Av., St. L.	Letter, Dr. Crowley.	Sept. 17	1 bey gelding	Glanders	"
J. F. Towel	4937 Audubon Av., St L.	Letter, Dr. Kammerer	Sept. 26	1 grey mare	"	Dead.
D. Criss	3827 St. Ferdinand av, St. Louis	Card, Dr. J. M. Phillip	Oct. 4	2 horses	"	Quarantined.
Wm. E. Magoon	1921 Biddle St., St. L.	Letter	Oct. 3	1 grey gelding	"	"
Fred Hofstetter	Taylor & Scott Avs. St. Louis	Letter, Dr. Kammerer	Oct. 4	1 horse	"	Dead.
S. Jones	Taylor & Scott Avs., St. Louis	Letter, Dr. Kammerer	Oct. 4	1 mule	"	"
J. M. Van Cloostere	Clayton, Mo	Letter, Dr. W. R. Harrison	Oct. 4	1 mule	"	Quarantined.
John Ward	Tay,or & Scott Avs., St. Louis	Letter, Dr. Chas. Ellis	Oct. 8	1 mule	"	"
E. Hughes	Mexico, Mo	U. S. Inspector	Oct. 8	67 sheep	Scabies	Quarantined stock pens.
Mrs. John Stack	304 S Kingshighway, St. Louis	Letter, Dr. Kammerer	Oct. 24	1 grey mare	Glanders	"
Jos. Gallaher	St. Louis, Mo	Letter	Oct. 24	1 horse	Glanders	Dead.
C P. Delore	201 Barton St., St. L.	Letter, Dr. A. J. Hammerstein	Oct. 28	1 black gelding	Suspected glanders	Advised keeping the horse isolated.
Harriman Bros	Pilot Grove, Mo	Message	Nov. 4	2 cows	Epizootic Aphtha	Epsom Salts, and careful feeding.

ANNUAL REPORT OF DR. W. F. BERRY, DEPUTY STATE VETERINARIAN FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Walter Richards.........	Mt. Vernon, Mo.......	Letter...........	1906. July 23..	1 horse.........	Scabies.............	Quarantined.

ANNUAL REPORT OF DR. H. F. BOETTNER, DEPUTY STATE VETERINARIAN FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
W. Winn, W. H. Hay....	Brunot, Mo...........	Telegram.........	1906. Apr. 3..	Cattle..........	Cerebro Spinal Meningitis...........	Advised proper Hygiene.
W. H. Smollinger........	Iron Mountain, Mo.....	Letter............	Sept. 12..	2 horses........	Chronic glanders.....	Shot and burned.

ANNUAL REPORT OF DR. E. BRAINERD, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
J. R. Buford............	Lancaster, Mo.........	State Veterinarian.	1906. Aug. 6..	87 sheep........	Scabies.............	Quarantined.

ANNUAL REPORT OF DR. J. W. CONNAWAY, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906.

Owner.	Postoffice	How called.	Date.	Kind of stock.	Disease.	How disposed of.
M. Weismann............	1008 N. 12th St., St. L.	Letter, Dr. T. J. Menestrina......	1906. July 26..	2 geldings.......	Glanders............	Quarantined and reported to county court.

ANNUAL REPORT OF DR. JAMES CULLISON, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
			1906.			
Mrs. C. M. Reimmer	Caruthersville	Telegram	March 12.	3 horses; 1 mule.	Chronic glanders	Reported to county court.
J. H., A. J., D. C., Zimmerman, J. L. Stevens and others	Glen Allen, Mo	Letter	May 8	12 horses & mules	Influenza	Advised proper treatment.
W. P. Boyles	Doniphan, Mo	Letter	June 25	2 horses	Glanders	Ordered killed by county court.
Stockmen of Doniphan	Doniphan, Mo	Letter	Sept. 17	Cattle in stock-pens	Fever ticks	Had straw placed over pen and burned.

ANNUAL REPORT OF DR. HORACE BRADLEY, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
			1906.			
J. H. Kitf	Butler, Mo	Geo. B. Ellis	Jan. 11	1 mare	Nasal catarrh	Advised treatment.
Trustin Williamson	Windsor, Mo	" "	Apr. 11	24 sheep	Grub	....
C. D. Moore	Lone Tree. Mo	" "	May 20	2 horses	Acute glanders	Quarantined.
C. D. Moore	" "	" "	May 29	2 horses	Acute glanders	Mallein test.
Al. McGoverney	Milo, Mo	" "	July 23	1 filley	Abscess	Treated.
C. D. Moore	Harrisonville, Mo	Dr. D. F. Luckey	July 30	2 horses	Glanders	Released from quarantine.
Mr. Greene	East Lynne, Mo	Geo. B. Ellis	Aug. 1	1 mare	Nasal gleet	....
S. A. Boatright	Lewis, Mo	" "	Sept. 24	1 cow	Postmortem revealed Texas fever	Dead on arrival.

ANNUAL REPORT OF DR. L. D. BROWN, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Andrew J. Elliott	Purdin, Mo	Geo. B. Ellis	1905. Dec. 25	Horses	Worms affecting bowels and blood vessels	Advised vermifuge and tonics.
J. R. Matthews	Meadville, Mo	Letter	1906. Jan. 6	2 horses	Glanders	Quarantined.
Thos. Kensella	Wheeling, Mo	Return visit	Jan. 19	3 horses	"	Ordered killed.
R. W. Taylor	Turney, Mo	Geo. B. Ellis	Jan. 25	1 horse		Held for observation.
C. S. Ballinger	Edina, Mo	Petition	Jan. 28	1 horse	Glanders	Quarantined.
R. W. Taylor	Turney, Mo	Return visit	Feb. 9	1 horse	Suspected glanders	Held for observation.
Messrs. Ross, Cheatum, Pinston, Keith	Edina, Mo	Geo. B. Ellis	Feb. 15	Horses	Glanders	Quarantined.
J. R. Matthews	Meadville, Mo	Return visit	Mar. 16	1 horse	Had been exposed to glanders	Released from quarantine.
R. W. Taylor	Turney, Mo	Return visit	Mar. 17	1 horse	Glanders	Held for observation.
Wm. Davis	Braymer, Mo	Dr. D. F. Luckey	Mar. 15	Sheep	Scabies	Quarantined.
J B. Miner	Newark, Mo		Mar 20	1 horse	Glanders	"
Wm. Miller	Pleona, Mo	Return visit	Mar. 20	3 horses	"	"
Robert Laske	Hurdland, Mo	Telephone	Mar. 21	Cattle	Anemia	Advised nutritious food, vegetable tonic.
Samuel Brock	Plattsburg, Mo	Dr. Luckey	Apr. 9	41 head cattle	Scabies	Quarantined.
E. W. Creason	Polo, Mo	Petition	Apr. 26	Horses & mules	Glanders and farcy	"
E. L. Swann	Edina, Mo	Return call	Apr. 27	1 horse	Sub-acute glanders	"
Peter Engberg	Bucklin, Mo		May 4	1 horse	Glanders	"
M. C. Morgan	St. Catherine, Mo	Petition	May 11	Horses	"	"
T. A. McCollum	St. Catherine, Mo	Geo. B. Ellis	May 11	5 horses	"	"
T. A. McCollum	St. Catherine, Mo	Return visit	May 16	5 horses	"	"
E. W. Creason	Polo, Mo	Return visit	May 19	1 horse	"	"
T. J. Street	Purdin, Mo	Petition	June 8	1 horse	Chronic glanders	"
Samuel Brock	Plattsburg, Mo	Dr. D. F. Luckey	June 12	Cattle	Scabies	"
E. W. Creason	Polo, Mo	Return visit	June 16	Horses	Glanders	"
J. W. Miller	Knox City, Mo	County Clerk	June 20	2 horses	"	"
T. A. McCollum, M. C. Morgan, R. E Grant	St. Catherine, Mo	Return visit	Aug. 8	Horses	Supposed glanders	Released from quarantine.
E. W. Creason	Liberty, Mo	Return visit	Sept. 3	2 horses	Chronic glanders.	Quarantined to be destroyed.
William Davis	Braymer, Mo	Dr. D. F. Luckey	Sept. 13	Sheep	Supposed scabies	

ANNUAL REPORT OF DR. H. V. GOODE, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906.

Owner.	Postoffice.	How called.	Date	Kind of stock.	Disease.	How disposed of.
			1906.			
Mr. Wylie	Stewartsville, Mo	Dr. D. F. Luckey	Jan. 9	23 sheep	Scabies	Quarantined stock pens.
T N. Glenn and S. H. Green	Tarkio, Mo	" "	Jan. 9	74 cattle	Scabies	Orde ed dipped with Beaumont Oil.
	Tarkio, Mo	" "	Jan. 23	58 cattle	"	" " " " "
Geo. Gordon	Tarkio, Mo	" "	Jan. 26	22 cattle	"	All Infected cattle shipped.
W. A. Thomas	Fairfax, Mo	" "	Feb. 24	Cattle	"	Quarantined R. R. yards.
Conrad Harvey	Winthrop, Mo	Geo. B. Ellis	Mar. 24	3 horses	Suspected glanders	Quarantined.
Jno. P. Stevenson	Tarkio, Mo	Dr. D. F. Luckey	May 9	Cattle		Quarantined R. R. yards.
	Grant City, Mo	" "	July 25	Horses	Mange	
Howell Christopher	Easton, Mo	Geo. B. Ellis	Aug. 3	3 hogs, 1 cow	Rabies	Had been killed.
L. H. Prather	Tarkio, Mo	D. F. Luckey	Aug. 30	Cattle	Exposed to scab	Quarantined R. R. yards.

ANNUAL REPORT OF DR. E. M. HENDY, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Mr. Mueller	Meta, Mo	Letter	May 17	1 horse	Heaves	

ANNUAL REPORT OF DR. R. C. MOORE, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
J. L. Foley	3800 E. 16th st, Kan. Cy.	By owner	1905. Dec. 27	2 mules	Chronic glanders	Quarantined and reported to county court.
C. T. Kornbrodt	2810 Prospect Av. "	"	1906. Jan. 2	1 horse	" "	Quarantined and reported to county court.
W. S. Michalucine	Mosby, Mo	Dr. D. F. Luckey	" 4	100 cattle	Suspected scabies	Quarantined.
C. Procter	2533 Askew Av. K. Cy,		" 6	1 horse	Chronic glanders	Quarantined and reported to county court.
F. M. Talbert	1901 Walnut St. "		" 7	2 horses	" "	Quarantined and reported to county court.
Allen Smith	43rd & Kensington "		" 9	1 horse	Old and blind	
J. D. Tarr	3316 Matthews Av. "		" 10	"	Chronic glanders	Quarantined and reported to county court.
J. H. Shoemaker	23 W. 10th st "		" 14	"	Glanders	Quarantined.
Unknown	City Market "	Humane officer	" 17	"	Catarrh of gutteral pouch	
Sam Prince	2419 Grove "	By Owner	" 17	"	Chronic Catarrh	
C. T. Kornbrodt	2810 Prospect Av. "	"	" 23	"	Chronic glanders	Quarantined and reported to county court.
I. Pickering	1914 Walnut st. "		" 24	"	Suspected glanders	Quarantined to be given Mallein test.
Unknown	5th & Forest "	Humane officer	" 25	"	Catarrh of maxillary sinus	Quarantined and reported to county court.
C. T. Kornbrodt	2810 Prospect Av "	Owner	" 25	"	Chronic glanders	Quarantined and reported to county court.
J. C. House	23rd & Grand "		" 27	"	Exposed to glanders	Released from quarantine
I. Pickering	2144 Walnut St "		" 31	"	Chronic glanders	Quarantined and reported to county court.
B. H. Birkshire	3044 S. W. Blod "		Feb. 15	"	" "	Quarantined and reported to county court.
H. Ross	1512 Holmes St "		" 25	"	" "	Quarantined and reported to county court.
James Bond	64th & Holmes St "	Owner	Mar. 12	"	Hemorrhage	

James Johnson	15th & Jackson	"		"	15	"	Chronic glanders	Quarantined and reported to county court
L. R. Fisher	1014 Campbell	"	Owner	"	25	"	" "	Quarantined and reported to county court.
Morris Resen	806 Indep. Av.	"	Owner	Apr.	5	"	Suspected glanders	Mallein test, no reaction.
Mr. Cain	412 Campbell	"	Owner	"	11	"	Hemorrhage	
B. F. Carey	3rd & Grand	"	Humane officer	"	11	"	Pyemia	
J. A. Robinson	3931 Main st.	"	Dr. Riley	"	13	"	Chronic glanders	Quarantined and reported to county court.
C. A. Brackett	2101 McGee St	"	Owner	"	13	"	Suspected glanders	Quarantined and reported to county court.
J. W. Rutt	911 Grand av.	"	"	"	14	"	" "	Quarantined and reported to county court.
C. A. Brockett	2101 McGee St.	"	Owner	"	18	"	" "	Held in quarantine.
E. J. Bowden	19th & Holmes, Kan. Cy		By Owner	Apr.	19	1 horse	Suspected glanders	Quarantined.
B. F. Cary	3rd & Grand,	"	"	"	19	"	" "	Destroyed with consent of owner.
E. J. Bowden	19th & Holmes,	"	"	"	21	"	" "	Held under quarantine.
G. Patrick	R. 5, Independence, Mo.		Humane society	"	22	"	Mange	Quarantined.
J. W. Rutt	911 Grand Av. Kan. Cy			"	25	"	Suspected glanders	Quarantine continued.
E. J. Bowden	19th & Holmes,	"		"	25	"	Glanders	Destroyed with consent of owner
R. G. Sawyer	3039 Holmes,	"	Dr. James	"	28	"	Chronic glanders	Quarantined and reported to county court.
Mr. Emanuelson	Westport, Mo		"	"	28	2 horses	Nothing found	
Unknown	74th & Troost, Kan. Cy.		Mr. Carpenter	"	29	"	Glanders	Destroyed.
Wolcott, Beers & Grant Com. Co	K. C. stock yards	"	Mr. Carlton	May	2	1 horse	Suspected glanders	Placed under quarantine
H. F. Ackerman	63rd & Troost,	"		"	3	"	Chronic glanders	Quarantined and reported to county court.
Simon Ancon	1106 Indep. Av.	"	Humane officer	"	4	"	Injury of leg	
F. H. Ackerman	63rd & Troost,	"	Dr. Gatchell	"	5	"	Suspected glanders	Quarantined.
American Transfer Co	1325 W. 9th St.,	"	Dr. Hadley	Apr.	7	1 mule	Acute glanders	Quarantined and reported to county court.
Wolcott, Beers, Grant Com. Co	Stock yards,	"		May	7	1 horse	Suspected glanders	Continued quarantine.
J. C. Houck	6800 Independence	"		"	8	"	" "	Quarantined.
J. W. Rutt	911 Grand av	"		"	8	"	Chronic glanders	Quarantined and reported to county court.
Albert Dietz	7306 E. 15th,	"		"	11	"	" "	Quarantined and reported to county court.
A. L. West	3115 Park Av.,	"	Owner	"	15	"	Suspected glanders	Quarantined, Mallein test.

ANNUAL REPORT OF DR. R. C. MOORE, DEPUTY STATE VETERINARIAN, FOR THE YEAR, DECEMBER 20, 1905, TO DECEMBER 18, 1906.—Continued

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
			1906.			
E. J. Smith	38th & Agnes, Kan. Cy.		May 16	1 horse	Catarrhal sore throat.	
G. Patrick	R. 5, Independence, Mo.		" 17	"	Mange	Quar. 4-22. Not released.
C. A. Brockett	2021 McGee st., Kan. Cy		" 22	"	Chronic glanders	Destroyed with consent of owner.
O. Johnson	1861 Benton Bl "		June 19	"	Suspected glanders	Test unsatisfactory. Held in quarantine.
P. T. McKennan	1304 Walnut st., "	Owner	July 3	"	Chronic glanders	Quarantined and reported to county court.
H. B. Smith	2523 Summit St., "	Dr. Crosby	" 9	1 mule	Suspected glanders	Held for development.
Mrs. M. Waights	2321 Wyandotte St.,"		July 10	1 horse	Chronic glanders	Quarantined and reported to county court.
H. B. Smith	2523 Summit St., K. Cy.		July 11	1 mule	Chronic glanders	Quarantined and reported to county court.
Nelson Cooperage Co	1500 W. 9th St., "	Humane officer	" 12	1 horse	Shipping fever	
P. T. McKernan	1304 Walnut St., "		" 15	"	Suspected glanders	Quarantined.
" " "	" " "		" 17	"	Suspected glanders	Still held in quarantine.
H. F. Schovill	33rd & Roanoke, "	Mr. Johnson	" 18	"	Stock yards fever	
Geo. Owens	2456 Vine St., "	Owner	" 19	"	Influenza	
E. J. Mathews	1910 Central Av., "	"	" 20	"	Suspected glanders	Held in quarantine.
" "	1637 Wyandotte, "	"	" 22	2 horses	Chronic glanders	Quarantined and reported to county court.
Unknown	1908 Central Av., "	E. J. Mathews	" 23	1 horse	Purpura hemorrhagacia	
J. T. Rucker	R. 36, Hickman's Mills, Mo	Geo. B. Ellis	" 31	5 horses	Glanders	Quarantined and reported to county court.
E. J. Mathews	1637 Wyandotte, K. Cy.	Owner	Aug. 1	1 mule	Chronic glanders	Quarantined and reported to county court.
S. & S. Beef Co	2nd & Walnut, "	"	" 2	1 horse	" "	Quarantined and reported to county court.
P. T. McKernan	1304 Walnut St., "	"	" 4	"	Suspected glanders	Held under quarantine.
H. Schelly	18th & Brooklyn "	Dr. Yost	" 4	"	Emphysema of maxillary sinus	
H. A. Hartman	710 McGee St., "		" 8	2 horses	Chronic glanders	Quarantined and reported to county court.

S. & S. Beef Co.	2nd & Walnut, "	Owner	" 9	2 horses	" "	Mallein test.
H. Little	406 Charlotte St., "		" 10	1 horse	" "	Quarantined and reported to county court.
E. Peterson	44th & Agnes, "	Owner	" 11	1 cow	Texas fever	Quarantined.
A. Rose	44th & Cleveland, "		" 13	Cows	Suspected Texas fever	Examination revealed no symptoms
Con Murphy	555 Grand Av., "		" 18	1 horse	Catarrh	
A. Helin	1028 W. 17th St., "	Humane officer	" 21	"	Bruises due to nail prick	
J. S. Smith	2218 Tracy Av., "	Owner	" 23	1 mule	Chronic glanders	Quarantined and reported to county court.
A. L. West	3115 Park Av., "	Owner	" 24	1 mule	" "	Destroyed.
H. B. Hedrick	10 E. 13th St., "	Dr. Gatchell	" 29	1 horse	" "	Quarantined and reported to county court.
Mr. Wedge	2025 Tracy Av., "	By owner	" 30	1 mule	Bad teeth	
John L. Stanley	Neighart, Mo	Geo. B. Ellis	" 31	Cattle	Belladonna poisoning	
Martin Murphy	3422 E. 6th St., K. Cy.	Dr. Merker	Sept. 2	1 mule	Chronic glanders	Quarantined and reported to county court.
E. Peterson	43rd & Agnes, "		" 7	1 cow	Texas fever	Released from quarantine.
C. H. Conklin	14th & Penn, "	Owner	" 8	1 horse	Purpuro	
Charlie Cook	2nd & Walnut, "	"	" 13	"	Chronic glanders	Quarantined and reported to county court.
J. T. Rucker	Hickman Mills, Mo		" 15	"	Suspected glanders	Released from quarantine.
Thos. Sheehy	807 Washington St., K. City	Dr. Merker	" 19	"	Chronic glanders	Quarantined and reported to county court.
J. C. Granger	2448 Brighton Av., K.C.		" 22	"	Suspected glanders	Quarantined and given Mallein test.
E. J. Mathews	1637 Wyandotte, "	Dr. Merker	" 25	"	Chronic glanders	Quarantined and reported to county court.
R. Messick	Kearney, Mo		" 28	"	Alveolar periostitis	
Metropolitan St. Ry. Co.	15th St. & Grand Av, K. City	Dr. Brown	Oct. 5	1 mule	Chronic glanders	Quarantined and reported to county court.
Henry Menth	1217 Summit St., K. C.	Owner	" 8	1 horse	" "	Quarantined and reported to county court.
J. C. Bradshaw	1313 Virginia Av., "	Dr. Byrd	" 12	1 mule	" "	Quarantined and reported to county court.
Chas. Runion	1st St. & Brooklyn Av., Kansas City	Owner	" 13	1 horse	" "	Quarantined and reported to county court.

ANNUAL REPORT OF DR. R. C. MOORE, DEPUTY STATE VETERINARIAN, FOR THE YEAR, DECEMBER 20, 1905, TO DECEMBER 18, 1906.—Continued

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
			1906.			
E. P. Robinson	1224 Locust St., K. City.		Oct. 15	1 horse	Chronic glanders	Quarantined and reported to county court.
E. J. Mathews	1637 Wyandotte St., "	Owner	" 16	"	" "	Quarantined and reported to county court.
J. W. Cribbs	1712 Prospect St., "	"	" 20	"	" "	Quarantined and reported to county court.
J. E. Goar	820 W. 39th St., "	"	" 21	"	" "	Quarantined and reported to county court.

ANNUAL REPORT OF DR. R. B. LOVE, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
			1906.			
H. N. Voss	Mt. Vernon, Mo	Secretary	Mar. 23	Horses & mules	Mange	Gave treatment
Various	Sparta, Mo	State Veterinarian	Sept. 21	Cattle	Texas fever	Quarantined.
"	"	" "	" 30	175 head cattle	"	"
"	Kissee Mills, Mo	" "	Oct. 16	193 cattle	"	"
Jas. Admier	Brouch, Mo.	Secretary	" 23	4 horses, 1 mule	Chronic glanders	"

ANNUAL REPORT OF DR. F. W. O'BRIEN, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Various	LaBelle, Mo	State Veterinarian	Jan. 2	Sheep	Scabies	Quarantined.
Hugh Latham	Duncan's Bridge, Mo	Secretary	1906. " 8	1 horse	Bronchitis (from description)	Dead.
Various	Elsberry, Mo	State Veterinarian	" 10	35 sheep	Scabies	Quarantined.
"	Dameron, Mo	" "	" 23	1 sheep	"	"
"	Eolio, Mo	" "	" 26	27 sheep	"	"
"	Silex, Mo	" "	Feb. 10	Sheep	"	"
M. J. Dunn	"	Secretary	Mar. 2	4 cows	Meningitis and indigestion	3 dead.
Hal Sitton	"	State Veterinarian	Apr. 3	1 cow	Enaphalitis	Dead.
Various	Lewiston, Mo	" "	July 1	Sheep & cattle	Scabies and meningitis	Quarantined sheep.
"	Monroe City, Mo	" "	" 24	Cattle	Fever ticks	Quarantined.
"	LaBelle, Mo	" "	" 25	Sheep	Scabies	"
"	" "	" "	Oct. 15	"	"	No disease found.

ANNUAL REPORT OF DR. S. SHELDON, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
			1906.			
Wm. Preyer	Farmersville, Mo	Telephone	Feb. 19	1 horse	Low choke	Dead.
G J. Stottbemyre	Osgood, Mo	Geo. B. Ellis	" 20	2 horses	Mexican mange	Quarantined.
W. L Jackson	"	" "	" 20	4 horses	" "	"
Chas. Wefer	Laredo, Mo	Letter	" 15	1 horse	" "	"
John McCloskey	Osgood, Mo	"	" 15	2 horses	" "	"
R. F. Johnson	Galt, Mo	"	" 15	2 horses	" "	"
Mrs. Jas. Meadows	Osgood, Mo	"	" 15	1 horse	" "	"
W. B. Weston	"	"	" 15	3 horses	" "	"
W. J. Cunningham	Spickard, Mo	"	" 15	4 horses	" "	"
W. R. Berry	Galt, Mo	"	" 15	2 horses	" "	"
J. A. Cunningham	Spickard, Mo	"	" 15	4 horses	" "	"
J. W. Neff	Osgood, Mo	"	" 15	2 horses	" "	"
E. M Vaughan	Princeton, Mo	"	" 15	6 horses	" "	"
J. E. May	Osgood, Mo	Geo. B. Ellis	" 15	27 horses & mules	" "	"
J. W. Tunnell	"	" "	" 15	3 horses	" "	"
F. W. Ingraham	Humphreys, Mo	" "	June 24	1 horse	" "	"
W. A. Jackson	Osgood, Mo	" "	" 24	2 horses	" "	"
Frank Brandon	Castle, Mo	Letter	Aug. 29	18 sheep	Scabies	"
T W. Norrell	Galt, Mo	Geo. B. Ellis	July 25	1 horse	Glanders	Killed.
**Ed. Kauffman	Princeton, Mo	Letter	Sept. 25	30 sheep	Scabies	Found free from disease
Various	Milan, Mo	"	" 30	103 sheep	"	Quarantined.
Messrs. Orndornff	Harris, Mo	"	" 26	240 sheep	"	"
A. L. Miller	Humphreys, Mo	"	Oct. 10	230 sheep	"	"
D. O. Swank	" "	State Veterinarian	" 10	151 sheep	"	"
W. R. Allen	" "	" "	" 10	7 sheep	"	"
G. T. Moberly	" "	" "	" 10	40 sheep	"	"
W. F. Roach	" "	" "	" 10	20 sheep	"	"
O. L. Shaffer	" "	" "	" 10	80 sheep	"	"
**Various	Trenton, Mo	Private Practice	Sept. 6	Cattle	Texas fever	"
"	" "	" "	" 17	"	"	"

ANNUAL REPORT OF DR. R. P POAGE, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
J. O. Neal	Clarence, Mo	State Veterinarian	1906. Jan. 5	Sheep	Scabies	Quarantined
J. W. McWilliams	Leonard, Mo	" "	" 8	7 sheep	"	"
Various	"	" "	" 10	Sheep	"	Quarantined and treated.
"	Burksville, Mo	" "	" 17	99 sheep	Scabies	Quarantined.
"	" "	" "	Feb. 19	"	"	"
"	" "	" "	" 21	155 sheep	"	Lime and sulpher dip.

ANNUAL REPORT OF DR. J. H. SLATER, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of
R. L. Stanley	Carrollton, Mo	Geo. B. Ellis	1906, Feb. 2	1 gelding	Strangles	Well upon arrival.
G. M. Jenkins	" "	" "	Apr. 12	9 horses	"	1 dead, others well upon arrival.
P. H. Jacobs	Henry, Mo	Owner	June 22	1 horse	Farcy	Quarantined.
B. F. Brown	Carrollton, Mo	Geo B. Ellis	" 27	1 mule	Suspected rabies	Held for observation.
Warren Reyburn	Henry, Mo	" "	" 29	2 mules	Suspected glanders	" " "
B. F. Brown	Carrollton, Mo	Return visit	July 16	1 mule	Suspected rabies	Released from quarantine.

ANNUAL REPORT OF DR. STANLEY SMITH, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Various	Thompson and Bowling Green	State Veterinarian	1905. Dec. 22	170 sheep	Scabies	Quarantined.
R. E. Streeter	Sturgeon, Mo	" "	1906. Jan. 28	24 sheep	"	"
John Boulware	Centralia, Mo	" "	Feb. 2	306 sheep	"	"
J. F. Brandige	" "	Dr. Ellis	Apr. 25	1 gelding	Abscess	Treated.
Mr. Nichols	Huntsville, Mo	State Veterinarian	May 31	1 horse	Glanders	Had been killed.

ANNUAL REPORT OF DR. T. E. WHITE, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Loyd Hoffman	Warrensburg	Geo. B. Ellis	1906. Jan. 6	2 cows	Spinal meningitis	Shut away from source-of infection.
W. P. Voigt	Hughesville, Mo.	" "	May 17	1 horse	Nasal catarrh	Gave treatment.

ANNUAL REPORT OF DR. H. H. WOLF, DEPUTY STATE VETERINARIAN, FOR THE YEAR DECEMBER 20, 1905, TO DECEMBER 18, 1906.

Owner.	Postoffice.	How called.	Date.	Kind of stock.	Disease.	How disposed of.
Mr. Meadows	Maitland, Mo.	State Veterinarian.	1905. Dec. 19	Cattle	Scabies	Quarantined stock pens.

INDEX.

A

Pages.
Aberdeen Angus cattle 238-245
Abortion 68-70
Agricultural College, report on 9
Agricultural College appropriation 11
Agricultural College building 12
Alfalfa 179, 181, 183
Annual meeting 9-46
    Report Agricultural College committee 9
    Report Auditing committee 14-15
    Election of officers 16
    Secretary's report 18-35
    Treasurer's report 36-37
    State Veterinarian's report 38-46
Apples, statistics on 400
Auditing Committee, report of 14-15

B

Babcock Test 68
Baby beef production 114-166
    What is baby beef? 116
    The professional feeder's practice 116
    Time required to make animals fat 119
    Relation of feeding period to quality of cattle 120
    Feeders prefer two-year-old cattle 125
    Relation of age to the cost of feeders 127
    Cheaper gains made on young animals 129
    Cost of gain due to age 130
    Selling price of cattle 137
    Influence of age upon cost of production 140, 141, 155, 156
    Influence of age upon cost of gain 142
    Calves and yearlings contrasted 146-147
    Calves and two-year-olds contrasted 147-148
    Calves and three-year-olds contrasted 148-149
    Yealings and two-year-olds contrasted 149-150
    Yearlings and three-year-olds contrasted 150-151
    Two-year-olds and three-year-olds contrasted 151-153
    Missouri results 153-158
Barley, average farm price 400
Beef, cost of making 59
Beef, beef and dairy production compared 59-60
Board of Agriculture—
    Officers of 2
    Executive committee 2
    Corporate members 3
    State Fair directory 3
    State Fair executive committee 4
    Veterinary officials 4

Pages

- Broomcorn, acreage, yield and value by sections 397
- Broomcorn, average farm price 400
- Buckwheat, average farm price 400

C

- Cattle, farm price 400
- Cattle, care of 99-100
- Cereal acreage and live stock in Ohio 261
- Cereal acreage and live stock in Missouri 263
- Certified milk 71, 95-101
- Chickens, average farm price 400
- Clover seed, average farm price 400
- Clover hay, average farm price 400
- Contagious diseases 41
- Contributors—
  - Boles, J. W. 210-213
  - Bright, W. A. 36- 37
  - Brown, R. W. 219-224
  - Crabtree, P. E. 319-326
  - Day, Dr. Edna D 101-107
  - Eckles, C. H. 76- 80
  - Ellis, Geo. B. 18-35, 389-401
  - Erf, Prof. O. 81- 87
  - Grimes, A. T. 207-210
  - Gurler, Hon. H. B. 68- 76
  - Hadley, Hon. H. S. 281-295
  - Harris, Col. W. A. 224-238
  - Hartley, C. P. 326-335
  - Hopkins, Dr. C. G. 245-260
  - Huston, H. A. 335-341
  - Johnson, W. E. 318-326
  - Jordan, S. M. 309-313
  - Laughlin, E. E. 296-299
  - Luckey, D. F. 38-46, 87-94, 402-403
  - Miller, M. F. 341-345
  - Miller, Walter 166-176
  - Mosher, Geo. C. 54- 57
  - Mumford, F. B. 199-207
  - Redmon, S. H. 66- 67
  - Smith, H. R. 176-199
  - Steveson, Geo., Jr. 238-245
  - Ten Eyck, A. M. 299-309
  - Thorne, C. E. 260-272
  - Trowbridge, E. A. 272-281
  - Wallace, Henry 313-318
  - Walker-Hayes 213-219
  - Washburn, R. M. 108-112, 349-388
  - Waters, H. J. 49-52, 57-66, 114-166
  - Williams, Walter 48- 49
  - White, B. D. 95-101
- Cotton, average farm price 400
- Cotton, average, yield and value by sections 398
- Cow peas, average farm price 400
- Corn Growers' Association, officers of 5
  - President's annual address 296-299
  - Seed and the seed bed 299-309
  - Farmers' breeding plot 309-313
  - The preservation of our tillable lands 313-318

Corn Growers' Association—Continued. Pages
  Seed corn 318-319
  Field treatment of the corn crop 319-326
  Methods and difficulties of corn breeding 326-335
  Experiments with varieties of corn in Missouri 335-341
  Corn varieties 341-345
  Resolutions 345-346
  Prize winners for the corn show 347-348
Corn—
  The seed and the seed bed 299
  The vitality of seed 303
  The breeding plot 309-313
  Seed 318
  Field treatment of 319
  Planting 322
  Cultivation 322-323
  The seed plot 323
  Harvesting 324-326
  Difficulties of breeding 326-335
  Experiments with fertilizers on corn 335-341
  Varieties 341-345
  Statistics on 390-392
  Acreage, yield and value by sections 396
  Average farm price 400
Crop review 389
Crop statistics 390-401
Crop yields by sections 399
Crops, summary of yields and values 399
Crops, average farm price 400
Cultivated acreage and livestock in Great Britain 267

D

Dairy Association, Missouri State 53-113
  President's opening address 54- 57
  Inevitability of dairying 52- 66
  What we make out of our cows, and how we do it 66- 67
  What I have learned in 3,000 years' personal experience with a cow. 68- 76
  Care of milk 76- 80
  Tuberculosis among cattle 87- 94
  The economical production of certified milk 95-101
  The farm home 101-107
  Silo experience in Missouri 108-112
  Resolutions 112-113
Dairying—
  Adapted to good land 65
  The improvement of the herd 349-388
    Profits in dairying 351
    Herd records 354-359
    Testing the cows 367
    Milk record sheet 370
    Milk testing machine 372
    Variations in tests of cream 380
    More butter than butter fat 381
    Adulteration of milk 382
    Babcock test 387

E

Experiments in pork production 216-219

F

Pages

- Farmers' week convention 47-348
  - Address of welcome 48- 49
  - Response to address of welcome........................ 49- 52
  - Missouri State Dairy Association........................ 53-113
  - Improved Live Stock Breeders' Association........................114-295
  - Missouri State Corn Growers' Association........................296-348
- Farm Home, The 101-107
- Feed for cows 98- 99
- Financial statement 24- 37
- Flax acreage, yield and value by sections........................ 397
- Flax, average farm price........................ 400
- Forage, statistics on 390-393

G

- Galloway cattle 219-224
- Grain required per 100 lbs. gain, cattle, hogs and sheep........................201-203

H

- Hay, statistics on 390-392
- Hay, acreage, yield and value by sections........................ 397
- Horses, what class shall we breed?........................272-281
- Horses, average farm price........................ 400

I

- Illustrations—
  - A high producing Jersey........................ 356
  - Baby beef made in Missouri experiments........................ 121
  - Breeding herd of the Agricultural College........................ 144
  - Cattle—Yearlings, thick and hard........................ 138
    - Three-year-olds ready to top the market........................ 126
    - Three-year-olds about finished 123
    - Two-year-olds in prime condition........................ 132
    - Beginning to show finish........................ 135
    - Comparative produce of 352-355
  - Comparative yields of corn........................336, 337, 339, 340,341
  - Experimental feeding sheds and lots........................ 115
  - Groups of cows showing comparative profit........................362-363
  - Holstein cow owned by Agricultural College........................ 365
  - Milk testing apparatus....367, 371, 372, 373, 374, 375, 376, 377, 378, 384, 385-387
  - Model dairy at Greenwood, Mo........................358,368
  - Percheron mares and colt owned by Agricultural College........................273-279
  - Pastures of the Agricultural College........................ 113
  - Rex McDonald, greatest living saddle horse........................ 275

K

- Kaffir corn, average farm price........................ 400

L

- Leaf tobacco, average farm price........................ 400
- Legislation 43- 46
- Linseed meal 136
- Live Stock Breeders' Association, Improved........................114-295
  - Baby beef production 114-166
  - Pedigree 166-170

Live Stock Breeders' Association—Continued. Pages

- Economical rations in beef production....176-199
  - Prairie hay vs. alfalfa.... 179
  - Corn and prairie hay vs. corn and alfalfa....179-181
  - Cost of producing 100 lbs. gain.... 182
  - Corn stover with corn and alfalfa.... 183
  - Use of linseed meal with corn and prairie hay....186-187
  - Protein concentrates compared 188-189
  - Wheat, bran and other feeds compared.... 190
  - Heavy and light ration of corn compared....196-197
  - Conclusions from the experiments....198-199
- Mutton production 199-207
- The 100 per cent. profit animal....207-210
- Advantages of pure-bred over grade sheep....210-212
- A word to the new breeder....213-216
- An experiment in pork production....216-219
- Galloway cattle 219-224
- The red, white and roan....224-238
- Aberdeen Angus 238-245
- Maintaining soil fertility....245-260
- Animal husbandry and soil fertility....260-272
- What class of horses shall we breed?....272-281
- Combinations 281-295

Live Stock Breeders' Association, officers of.... 5

Live stock, average farm price.... 400

Live stock, condition of.... 401

M

Manure, farmyard—value of 269-270

Milk production 360-361

Milk, adulteration of.... 382

Milk, specific gravity of.... 383

Milk preservatives 388

Milking machines 66, 81- 87

Missouri herds 349-388

Mules, average farm price.... 400

Mutton production 199-207

- Grain required per 100 lbs. gain....201-203
- Grain with pasture 204
- Rations for fattening sheep.... 206

O

Oats, statistics on 393-395

Oats, acreage, yield and value by sections,.... 396

Oats, average farm price.... 400

Odors in milk 77

P

Pedigree 166-176

Pork production, experiments in....216-219

Potatoes, acreage, yield and value by sections.... 398

Potatoes, average farm price.... 400

Profit in cows 74- 76

Prizes, State Corn show....347-348

Protein concentrates in fattening cattle....188-189

Pure food law.... 12

R

Pages

Rations for fattening sheep.... 206
Rations for fattening hogs 217
Report—
    Of Secretary 18- 35
    Of Treasurer 36- 37
    Of State Veterinarian 38- 46
Rye, acreage, yield and value by sections.... 397
Rye, average farm price.... 400

S

Sheep Breeders' Association, officers of.... 6
Sheep, average farm price.... 400
Sheep, scabies 39
Shorthorn cattle 224-238
Silage 67
Silo experience in Missouri....108-112
Soil, preservation of 313
Soil fertility 245-260
    Maintained by animal husbandry....260-272
Soil survey 10
Sorghum seed, average farm price.... 400
State Fair, officers of.... 3- 4

T

Testing cows 71- 72
Tick fever 40- 41
Timothy seed, average farm price.... 400
Timothy hay, average farm price.... 400
Tobacco, acreage, yield and value by sections.... 398
Tuberculosis 42, 87- 94
Tuberculin test 92- 94
Turkeys, average farm price.... 400

V

Veterinarian, State and deputies.... 4
Veterinarian, reports of 38-46, 402-416

W

Wheat, statistics on....393-395
Wheat, acreage, yield and value by sections.... 396
Wheat, average farm price.... 400
Wool, average farm price.... 400

New York Botanical Garden Library
3 5185 00258 3779